NISTIR 7355

Development of a Fluorescence Based Measurement Technique to Quantify Water Contaminants at Pipe Surfaces During Flow

Mark A. Kedzierski

NIST
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

NISTIR 7355

Development of a Fluorescence Based Measurement Technique to Quantify Water Contaminants at Pipe Surfaces During Flow

Mark A. Kedzierski

U.S DEPARTMENT OF COMMERCE
National Institute of Standard and Technology
Building Environment Division
Building and Fire Research Laboratory
Gaithersburg, MD 20899-8631

September 2006

Development of a Fluorescence Based Measurement Technique to Quantify Water Contaminants at Pipe Surfaces During Flow

M. A. Kedzierski
National Institute of Standards and Technology
Bldg. 226, Rm B114
Gaithersburg, MD 20899
Phone: (301) 975-5282
Fax: (301) 975-8973

ABSTRACT

This paper provides a detailed account of the development of a fluorescence based measurement technique for measuring the mass of contaminant on solid surfaces in the presence of water flow. A test apparatus was designed and developed for the purpose of studying adsorption and desorption of diesel to and from a copper test surface in the presence of contaminated and fresh water flow, respectively. A calibration technique was developed to correlate the measured fluorescence intensity to the mass of diesel adsorbed per unit surface area (the excess surface density) and the bulk concentration of the diesel in the flow. Both bulk composition and the excess surface density measurements were achieved via a traverse of the fluorescent measurement probe perpendicular to the test surface. Two nominal bulk mass fractions (0.2 % and 0.3 %) were tested each for five different Reynolds numbers between zero and 7000. Measurements for a given condition were made over a period of approximately 200 h. The measured diesel excess surface density varied between zero and 0.02 kg/m^2 for the variation in the bulk mass fraction and Reynolds number of the flow. Normalized Freundlich constants were calculated for the various bulk mass fractions and Reynolds numbers.

Keywords: adsorption, contaminant, diesel, excess layer, fluorescence, measurement technique, sorption, water

LIST OF TABLES

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Since the signing of the Executive Order establishing the Office of Homeland Security, Federal agencies have been working on ways to improve the security of the general public. One way in which the National Institute of Standards and Technology (NIST) is doing its part is by helping the U.S. Environmental Protection Agency (EPA) devise ways to safeguard the nation's drinking water supply. EPA is conducting potable water research with NIST on six different efforts. This report describes one of those efforts designed to fundamentally understand the attachment and detachment mechanisms of contaminants to solid plumbing materials under dynamic water flow conditions. The results of this work provide EPA with an investigative tool to support the development of a response to water contamination events and a potential detection technique for timely warning of such events.

The purpose of this study is to apply a NIST fluorescence based measurement technique that was developed for measuring the mass of lubricant at the wall during boiling of refrigerants (Kedzierski, 2001) to measuring the mass of diesel on a copper pipe surface in the presence of flowing water/diesel mixture. In this way, we not only gain vital fundamental modeling information but we lay the groundwork for a possible early detection/monitoring system for sticky contaminants. Two major efforts have been focused toward the development of an in situ fluorescent measurement technique. First, a calibration technique was developed specifically for quantifying the amount of diesel on a copper pipe surface. Second, a water loop was designed and constructed consisting of a test chamber for subjecting small samples of pipe substrate materials to known concentrations of diesel/water solutions under controlled dynamic flow conditions. These two efforts have formed the foundation for future work that will focus on using the water loop and the calibration technique to measure the accumulation and removal of diesel as a function of free-stream diesel concentration and flow rate.

Commercial diesel was used rather than a chemically simpler surrogate in order to demonstrate the use of the technique with an actual potential contaminant. Diesel was also a desirable test contaminant because it has been found to exhibit a strong fluorescence. However, because of the complexity and the variability of diesel, the diesel for the project was restricted to a single batch. In this way, we can ensure the consistency of the properties of pure diesel[1] such as its liquid density and fluorescence characteristics.

EXPERIMENTAL APPARATUS AND UNCERTAINIES

The standard uncertainty (u_i) is the positive square root of the estimated variance u_i^2. The individual standard uncertainties are combined to obtain the expanded uncertainty (U), which is calculated from the law of propagation of uncertainty with a coverage factor. All measurement uncertainties are reported at the 95 % confidence level except where specified otherwise.

Figure 1 schematically shows the flow loop for measuring diesel on pipe substrates. The primary components of the loop are the pump, the reservoir, and the test chamber with the test section. The inside surfaces of the approximately 96 mm x 1.6 mm rectangular flow cross-section of the aluminum test chamber, shown in Fig. 2, were black anodized to

[1] "Pure diesel" is used here to denote that the particular batch of diesel, which will be consistently used throughout this project, is not mixed with water.

minimize stray light reflections. The channel was designed to have the same flow area as a 13 mm diameter copper tube. The test chamber had a circular cavity to accept the solid pipe test section. The height of the channel was 1.6 mm so that the probe could be flush to the top of the test section while maintaining proximity to the test surface for measurement purposes without being an obstruction to the flow. A centrifugal pump delivered the contaminated water to the entrance of the rectangular test chamber at room temperature. The pump head was removable so that it could be easily replaced in order to test a different contaminant. The flow rate was controlled and varied by varying the pump speed with a frequency inverter. A heat exchanger immersed in the reservoir was supplied with brine from a temperature-controlled bath to maintain the entrance temperature to the test chamber at ambient temperature (293.8 K). This was done to ensure that the diesel was at the same temperature as it was during the fluorescence calibration to avoid the temperature effect on fluorescence (Miller, 1981). An additional temperature-controlled bath was used to maintain the fluorescence standards at the same ambient temperature.

Residential copper pipe was used to plumb together the various components of the loop. Redundant volume flow rate measurements were made with an ultrasonic doppler and a turbine flowmeter with expanded uncertainties of ± 0.12 m^3/h and ± 0.03 m^3/h, respectively. As shown in Fig. 1, three water pressure taps before and after the test chamber permit the measurement of the upstream absolute pressure and the pressure drops along the test section with expanded uncertainties of ± 0.24 kPa and ± 1.5 kPa, respectively. Also, a sheathed thermocouple measured the water temperature at each end of the test chamber to within an uncertainty of ± 0.25 K. The dissolved oxygen level, the conductivity, and the pH, were monitored at the water reservoir with associated B-type uncertainties of ± 0.5 %, ± 50 μ $(\Omega cm)^{-1}$, and ± 0.3, respectively.

Figure 1 also shows the inlet and exit taps that were used to flush the test section with fresh tap water. In preparation for flushing, the test section was isolated with valves from the rest of the test loop. Then the fluid was drained from the test chamber and returned to the reservoir. Next, a tap water supply was connected to a test chamber port. The other test chamber port was connected to a filter to absorb any diesel before it was sent to a drain.

Figure 2 shows a view of the spectrofluorometer that was used to make the fluorescence measurements and the test chamber with the fluorescence probe perpendicular to the flattened pipe test surface. Figure 3 shows a simplified schematic of the right angle spectrofluorometer consisting of a xenon light source, an excitation and an emission monochromator, and an emission photomultiplier tube (detector). The spectrofluorometer was designed to accept 45 mm × 10 mm × 10 mm fluorescent samples or cuvettes filled with fluorescent material. A special adapter with lenses and mirrors, which replaced the cuvette holder, was fabricated to remotely excite and measure fluorescence via a bifurcated optical bundle. Two optical bundles consisting of 84 fibers each originated from the spectrofluorometer. One of the bundles transmitted the excitation light, i.e., the incident intensity (I_o), to the test pipe surface. The other bundle carried the emission, i.e, the fluorescence intensity (F), from the test surface to the spectrofluorometer. The optical bundles originating from the spectrofluorometer merge transmitting and receiving fibers randomly into a single probe before entering the test section chamber. The sensor end of the fluorescence probe is sheathed with a quartz tube to protect it from reacting with the contaminant in the test fluid.

As the name suggests, right angle spectrometry was designed to limit the interference of the excitation signal on the emission signal by orientating the detector perpendicular to the beam of the emission monochromator. Considering this, the parallel configuration of the excitation and emission at the measuring end of the bifurcated optical bundle as shown in Fig. 2 is not ideal but was necessary for this application. The parallel configuration allows the reflection of the excitation from the copper surface to be transmitted through the emission fiber optics and to the detector. This can be a serious limitation given that the reflected excitation can overwhelm the emission signal even if the emission wavelength (λ_m) and the excitation wavelength (λ_x) differ because: (1) the excitation intensity can be several orders of magnitude greater than that of the fluorescence emission, and (2) the filtering process of the emission monochromator is not complete enough to entirely remove the reflected wave. The filtering process of the monochromator supplies the detector with an intensity that is distributed about the desired wavelength but with relatively small tails at larger and smaller wavelengths. Consequently, if the excitation intensity is very large, the tails of the excitation distribution can be greater than the peak emission intensity. A successful remedy for reducing the interference of the excitation signal was to place a 10 nm bandwidth bandpass interference filters at the exit of the excitation monochromator and one before the entrance to the excitation monochromator. Figure 3 schematically shows the placement of the bandpass interference filters.

The excitation wavelength and the emission wavelength were set to 434 nm and 485 nm, respectively, for all tests. As Appendix A details, the choice of these wavelengths ensured that a significant and measurable emission signal was obtained with no measurable overlap of the excitation and emission spectra.

TEST FLUIDS

A 2 % by mass diesel mixture was prepared with local Gaithersburg, MD tap water and the mixture was left to form a colloid for approximately 3 months to provide sufficient time for the diesel and the water to reach equilibrium. While the method of preparation may not reflect the most likely contamination scenario, the methodology does provide a consistent test fluid for examining the effect of flow rate on contamination because the flow rate is varied for fixed fluid properties. The measured dissolved oxygen level, the conductivity, and the pH, of the water at 24 ºC before mixing with diesel were found to be, 86.4 %, 358 μΩ/cm, and 7.04, respectively. Number 2 diesel fuel was used from a single batch throughout the experiment to avoid property variations that might be caused by batch variations due to it being a complex mixture of hydrocarbons. Appendix B provides the measured viscosity and density of the pure diesel liquid.

Because diesel is a complex mixture, its hydrolysis results in a dispersed phase of differing components that reside in separate regions of the colloid depending on the density, dispersion size, and hydrophobic nature of each component. If quiescent, the test reservoir had a stable Brownian suspension within the bulk water, which likely differed chemically from the dispersed phase that floated on top of the bulk liquid, and that which rested on the bottom of the reservoir. The result of and the evidence for a chemical breakdown of the diesel is given in Appendix C, which shows that the peak fluorescence emission for the emulsified water diesel mixture taken from the reservoir exists at a wavelength that is 25 nm greater than that of pure diesel. Because of the hydrolysis of diesel, positive and/or negative bias errors are likely to occur in the mass measurement depending on the individual spectra of the fluorescing components of the hydrolyzed diesel. For example, a positive bias error may result because nonfluorescent components that contributed to the diesel mass during the calibration may not deposit on the surface. Likewise, a negative bias error may occur because the peak intensity of the fluorescent material on the test surface has shifted from that of the calibration.

The hydrolysis of the diesel and the configuration of the inlet and the outlet of the reservoir influence the flow in the test section. As shown schematically in Fig.1, the opening of the pump suction line in the reservoir is situated approximately 10 mm below the liquid-air interface. This design entrains the hydrolyzed diesel floating on the water surface with that in the bulk water, and on the bottom of the reservoir into the pumped flow. The return flow entering the bottom of the reservoir ensured good flow mixing. Figure 4 depicts the colloidal flow within the test section and the fluorescent measurement probe above it for the contamination and decontamination test conditions. The size of the droplets in the dispersed flow is exaggerated for illustration purposes. Both test conditions are shown to have an excess layer thickness (l_e) of undiluted hydrolyzed diesel adsorbed to the test surface. Because the molar mass of the diesel is unknown, the surface excess density (Γ) is defined in the work on a mass basis as (Kedzierski, 2001):

$$\Gamma = l_e(\rho_d - \rho_b x_b) \tag{1}$$

The density of liquid diesel is ρ_d. The density of the bulk mixture ρ_b is evaluated at the bulk mass fraction of the mixture (x_b). The surface excess density is roughly the mass of diesel attached per surface area. The Γ and l_e are the primary measurements of this study.

MEASUREMENTS AND UNCERTAINTIES

Fluorescence/Mass Calibration

Fluorescence as a means for detecting a contaminant has its advantages in that its absorption and fluorescence spectra are like a fingerprint that can be used in its identification. Consequently, by isolating the wavelength of light that the contaminant fluoresces, its intensity can be used to identify its mass. This is true even when the contaminant is mixed with another fluorescent or nonfluorescent substance as long as the fluorescent substance does not absorb and emit at the same wavelengths as the contaminant. For this reason, the tap water was examined and it was not found to fluoresce at any wavelength for any excitation wavelengths between the range or 200 nm and 800 nm. Consequently, interference from water is not possible via it contributing to the intensity of the fluorescence signal.

The calibration technique that was developed here for detecting the mass of diesel on a copper surface exposed to a flowing dilute mixture of diesel in water is introduced in the following. Two different calibration methods had to be combined due to the additional complexity caused by immiscible liquids. Both calibration techniques were used to quantify different functional aspects of the Beer-Lambert-Bougher law (Amadeo et al., 1971), which forms the basis of the calibration equation. The first method is essentially the same as the original NIST calibration method that was used to detect lubricants on boiling surfaces (Kedzierski, 2002). This methodology was used to obtain the relationship between diesel composition and fluorescence intensity for a fixed light path length (fixed probe height above the test surface).[2] The second method, that was developed in this study, relies on a perpendicular traverse of the flow stream with the measurement probe. To achieve this, a linear positioning device with a graduated knob was adapted to the quartz tube as shown in Fig. 2. The second method (traverse method) is used to calibrate the effect of contaminant thickness (path length) and the proximity of incident intensity. The traverse method is essential for splitting the total measured fluorescent intensity into two components: that from the diesel on the test surface and that from the diesel in the bulk flow stream. In this way, the mass of diesel on the test surface and the composition of the fluid stream are determined.

Figure 5 shows the vessel that was used in the first method to calibrate the fluorescence intensity received from the bifurcated optical bundle against the mass fraction of diesel. The lid of the 150 mL black, anodized, metal jar had a port for evacuation[3] and filling of the test sample and a fitting to seal around the stainless tube that pierced the lid. The stainless tube had a quartz tube and a quartz bottom welded to its end and it was the same type that was used in the test chamber of Fig. 2. A disk of copper pipe material was placed on the bottom of the jar. By using the same material and surface roughness, the disk and the test pipe had the same reflective properties. Copper from a flattened pipe was evenly oxidized by electrolysis and soldered to the top of the calibration disk that had circumferentially machined grooves for sealing in the test chamber. The same disk was used as the calibration disk and the test surface to compensate for unknown surface effects. The distance between the top of the calibration disk and the bottom of the quartz tube was set with the aid of a 1.6 mm Teflon[4] gauge disk and micrometer dial indicators. This fixes the path length of the fluorescence and the mass of fluorescent liquid below the probe. During calibration, the jar and the portion of the quartz tube above the lid were covered with black insulation to prevent the optical probe from receiving ambient light. The probe rested on the inside-bottom of the quartz tube.

Three jars were used to calibrate the mass fraction of diesel to the fluorescent intensity. Two jars were used as standards to set the lower (0) and upper (100) limits of the intensity signal on the spectrofluorometer. A jar that contained only pure water was used to zero the intensity. Because light intensities are additive, the zeroing ensured that the reflected

---

[2] The first method would have been sufficient had the bulk composition of the flow remained the same as it was charged in the reservoir. Due to the immiscibility of the two fluids, the bulk composition of the flow differs from that in the reservoir.

[3] It has been found that weak evacuation of a vessel containing diesel does not measurably change its fluorescent characteristics.

[4] Certain trade names and company products are mentioned in the text or identified in an illustration in order to adequately specify the experimental procedure and equipment used. In no case does such an identification imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products are necessarily the best available for the purpose.

excitation wave and other effects were not attributed to fluorescence. A second jar that contained pure diesel was used to set the intensity on the spectrofluorometer to 100. The third jar was used to measure and record the intensity of various mixtures of diesel and nonfluorescent n-decane of different concentrations. N-decane was used instead of water because it was miscible with diesel and also non-fluorescent. As an additional precaution, all raw-measured intensities (F_r) were numerically normalized by the intensity from the zero-jar (F_0) and the maximum-jar (F_{100}):

$$F = \frac{F_r - F_0}{F_{100} - F_0} \tag{2}$$

where the intensity of the contamination data was adjusted (see Appendix D) by no more than 0.3 % to account for the small (typically within ± 1 K) difference in temperature between the test section and the bath containing the maximum- and the zero-jars. The maximum correction for the flushing data was greater (1.5 %) than for the contamination measurements due to the colder temperature of the house tap water.

Evacuation of the jar was done to prevent fluorescence quenching by oxygen (Guilbault, 1967). N-decane was used because it is miscible with diesel. Calibration measurements proceed by successively adding or removing diesel in appropriately small increments. As shown in Appendix E, the fluorescence intensity was fitted linearly with respect to the diesel mass fraction to within a residual standard deviation of ± 1.2 %.

The second calibration method involved pure diesel alone and varying the thickness of the diesel below the quartz probe to determine the effect of the proximity of the incident light (I_o) and its path length (l). For these tests, the probe was traversed through the diesel and diesel thickness below the quartz probe was synonymous with the path length. As shown in Fig. 2, a linear positioning device with a graduated knob was used to locate the quartz tube relative to the test surface and thus measure the path length of the incident light through the diesel. The measured fluorescent intensity versus the path length was non-linear as shown in Appendix E. Given that the intensity versus mass fraction followed a linear relationship, the nonlinear aspect of the intensity versus l was due to the variation in the incident intensity with l. For this reason, further calibrations were done with fixed diesel film thickness and variable path lengths and it was observed that $\frac{1}{F}\frac{dF}{dl}$ was approximately constant for all ranges of the F and l traverse data for fixed diesel film thickness. This demonstrates the exponential dependence of I_o with the proximity of the probe to the diesel (l) and that this was the cause of the nonlinear calibration with respect to l. The I_o path length effect is known as excitation absorbance (Herman, 1998), which results from the diesel nearest to the light source receiving more excitation than the diesel that is further away.

The linear form of the Beer-Lambert-Bougher law (Amadeo et al., 1971) was used to correlate the measured intensity of the fluorescence emission (F) to the mass of diesel:

$$F = 2.3 I_o \varepsilon c l \Phi \rightarrow \left[\varepsilon c l \leq 0.05\right] \tag{3}$$

Here c is the concentration of the fluorescent diesel, which can be rewritten as a product of the bulk contaminant (diesel) mass fraction (x_b) and the bulk liquid mixture density (ρ_b) divided by the molar mass of the contaminant (M_c). Appendix F shows that the linear criteria for eq. (3) ($\varepsilon cl \leq 0.05$) is satisfied for 78% of the calibration data and the absorbance (εcl) did not exceed 0.063. In addition, the use of the full, nonlinear Beer-Lambert-Bougher law did not reduce the residual standard deviation of the fit. Consequently, use of the linear form of the law is justified.

The mixture densities were calculated on a linear mass weighted basis. The quantum efficiency of the fluorescence (Φ), the extinction coefficient (ε), the intensity of the incident radiation (I_o), and the M_c are all unknowns that are lumped into two regression constants and an exponential term to give the regressed calibration of F against x_b for diesel as:

$$F = \frac{2.3 I_o \Phi \varepsilon}{M_c} l x_b \rho_b = 1.04735 \left[\frac{\mathrm{m}^2}{\mathrm{kg}} \right] l x_b \rho_b e^{-209.23\,\mathrm{m}^{-1} l} \tag{4}$$

Equation (4) shows that $2.3 I_o \Phi \varepsilon M_c^{-1} = 1.04735 \left[\mathrm{m}^2 \mathrm{kg}^{-1} \right] e^{-209.23\,\mathrm{m}^{-1} l}$. The uncertainty of the calibration given in eq. (4) is approximately ± 0.2 % of F for the 95 % confidence level.

Figure 6 shows that the resulting calibration for the flow conditions is linear. The regression of the same measurements against the Beer-Lambert-Bougher law (Amadeo et al., 1971) gave a greater fit uncertainty suggesting that the linear fit is more appropriate.

Application of Calibration

Given that Γ and l_e are the primary measurements of this study, the main use of the calibration is to solve for these parameters. For the case where the diesel remains completely immiscible with water and has a strong affinity for metal surfaces, an excess layer of pure diesel will form on the pipe surface of thickness l_e.

Equation 3 can be rearranged to solve for the diesel excess layer thickness by setting the mass fraction, and the mixture density to reflect the properties of pure diesel:

$$l_e = \frac{F}{2.3 I_o \Phi \varepsilon M_c^{-1} \rho_d} = A_0 + A_1 l \tag{5}$$

As shown in Fig. 7, l_e can be regressed to eq. (5) using measurements of F for given values of path length (l) and plotted versus l. The two example F versus l data sets shown in Fig. 7 were obtained by moving the optical bundle closer to the test surface in order to vary the path length. As illustrated by the open circles, most of the resulting values of l_e for a given data set were directly proportional to l; hence, a linear relationship with respect to l including fitting constants A_0 and A_1 is shown on the rightmost side of eq. (5). Although, eq. (5) can be used to calculate as many values of l_e as long values of F and l can be supplied, it is valid only for when the path length and the excess layer thickness coincide (for non-zero bulk compositions) because it has been derived for pure diesel. This condition can be met by setting l to l_e in the rightmost portion of the eq. (5) and solving for l_e:

$$l_e = \frac{A_0}{1 - A_1} \tag{6}$$

For traverse data sets that are not linear for the full range of l, as illustrated by the open square symbols in Fig. 7, only the data that is approximately linear near the wall was used to generate constants A_0 and A_1.

Equation 6 is necessary only for a non-zero bulk mass fraction (x_b). For flushing tests, where $x_b = 0$, eq. (5) is valid for all $l \geq l_e$. Consequently, the excess surface density of diesel for flushing tests is obtained from an average of the l_e obtained from eq. (5) and the traverse measurements.

As shown in Appendix G, roughly 85 % of the l_e measurements have a relative uncertainty of less than 25 % for the 95 % confidence level. For these measurements the average uncertainty of l_e is approximately ± 7 % of l_e. Overall, the average uncertainty of l_e was approximately ± 0.2 µm.

The bulk mass fraction can be obtained by dividing the total fluorescence signal (F) into its components along the path length while assuming a uniform bulk mass fraction. The total intensity is the sum of that contributed by the bulk concentration ($F_l(x_m = x_b)$) for the entire path length and that in the diesel excess layer ($F_{le}(x_m = 1)$) minus the intensity that would have been due to the bulk concentration but did not occur because it was displaced by the excess layer ($F_{le}(x_m = x_b)$)

$$F = F_l(x_m = x_b) - F_{l_e}(x_m = x_b) + F_{l_e}(x_m = 1) \tag{5}$$

Substitution of eq. (4) into the components of the above equation and grouping like terms gives:

$$F = 2.3 I_o \Phi \varepsilon M_c^{-1} \left[l x_b \rho_b - l_e x_b \rho_b + l_e \rho_d \right] \tag{8}$$

Here ρ_d is the density of liquid diesel.

When the expression for the linearly mass fraction weighted ρ_b is subsitituted into eq. (8), its solution is quadratic in x_b with only one root that is less than or equal to 1.

$$x_b = \frac{1}{2}\left(\frac{1}{1 - \frac{\rho_d}{\rho_w}}\right) - \frac{1}{2}\sqrt{\left(\frac{1}{1 - \frac{\rho_d}{\rho_w}}\right)^2 - \left(\frac{4\left(\frac{F}{2.3 I_o \Phi \varepsilon M_c^{-1}} - l_e \rho_d\right)}{(l - l_e)(\rho_w - \rho_d)}\right)} \tag{9}$$

where ρ_w is the density of liquid tap water. The average uncertainty of x_b was approximately ± 0.002.

Air Gap Calibration

A secondary methodology was developed that relies on the gradient of F rather than its absolute value in order to confirm the measurement of l_e as obtained from eq. (5) or eq. (6). The advantage of a gradient approach would be the elimination of a bias error on the measurement of F if it existed. As shown in Fig. 4, part of the excitation is reflected from the diesel-air interface and is not available to enduce flourescence. Consequently, the calibration must be adjusted to account for the air gap during the drained test chamber measurements. Appendix E provides the derivation of the air-gap l_e and the result is given here as:

$$l_e = \frac{-0.0121\text{m} \frac{dF_{ag}}{dl} M_c}{2.3 I_o \Phi \varepsilon x_m \rho_m} = -0.01156 \frac{\text{kg}}{\text{m}} \frac{\frac{dF_{ag}}{dl} e^{209.23\text{m}^{-1} l}}{x_m \rho_m} \qquad (10)$$

MEASUREMENT RESULTS

Excess Layer Thickness

The test apparatus shown in Fig. 1 was used to submit an oxidized copper disk to exposure tests with two different bulk concentrations of diesel in tap water under varying flow conditions. More specifically, contamination measurements over an approximate 200 h time period were made for five different Reynolds numbers varying from 0 to 7000:

$$\text{Re} = \frac{4\dot{m}}{\mu_b p_w} \qquad (11)$$

where the wetted perimeter of the channel was 195 mm, the viscosity of the mixed bulk flow (μ_b) was calculated using a nonlinear mixture equation, and the mass flow rate ($\dot{m}$) was obtained from the turbine meter. Flushing measurements were done for a fixed Re of approximately 5000. The range of Reynolds numbers result from using a range of volume flow rates that a half-inch diameter tube would experience in typical buildings. After each contamination tests, the test surface was cleaned with acetone and clean tap water. Appendix H provides tabulated measurements for both the raw and reduced data.

Figures 8 provides the measured diesel layer thickness as caused by an exposure to a flowing water/diesel (99.8/0.2) mixture, i.e., diesel at approximately 0.2 % bulk mass fraction (2000 ppm). The exposure time is the duration of exposure of the test surface to the flow starting from when the clean surface was first exposed to a particular flow condition. For all flow rates and exposure times, the average l_e for x_b = 0.2 % obtained from the eq. (6) methodology was approximately 2.3 µm.

Figures 9 provides the measured diesel layer thickness as caused by an exposure to a flowing water/diesel (99.7/0.3) mixture, i.e., diesel at approximately 0.3 % bulk mass fraction (3000 ppm). A much larger variability in the measurements is evident for the 0.3 % mass fraction than for the 0.2 % mass fraction condition. For all exposure times and Re, the average l_e for x_b = 0.3 % was approximately 7.4 μm, which is 5.1 μm (222 %) thicker than the average thickness observed for the 0.2 % mass fraction tests.

Figure 10 crossplots all of the excess layer measurements of Fig. 8 as a function of Re. Figure 10 shows that the maximum diesel excess layer thickness of approximately 8 μm occurred at a Re near 4800. For Re larger and smaller than 4800, the diesel excess layer was thinner. For example, the l_e for Re near 1900 and 3800 was approximately 1 μm, which is nearly eight times less than the maximum l_e. The l_e for Re greater than 6000 was approximately 3 μm. Figure 11 crossplots all of the excess layer measurements of Fig. 9 (the 0.3 % mass fraction tests) as a function of Re. Figure 11 shows that the maximum film thickness of approximately 26 nm occurred at a Re of approximately 4000. Consequently, a maximum for the diesel adsorption exists near a Re of 4000 for both freestream concentrations. The dashed lines given in Figs. 10 and 11 represent the maximum measured excess layer for each range of Re tests. The variation in Re for a given set of tests for "fixed" Re was caused by an approximate 1 % variation in the water temperature during startup and the an approximate 15 % variation in the water flow during the nearly 200 h test duration.

Filled symbols in Figs. 8 and 10, shown between 150 h and 200 h, represent l_e measurements that were made at the end of the exposure tests after the test section was drained using the air-gap technique as a secondary measurement technique. For the water/diesel (99.8/0.2), mixture all three of the drain checks were within ± 1.5 μm of the measurements that were made while the test fluid was flowing. For example, for the air-gap check obtained using eq. (10) for the Re near 7000 condition produced a l_e near 3 μm, while the last measurement made with eq. (6) produced a l_e near 3.7 μm. Similarly, eq. (6) produced a l_e of approximately 2 μm for both the no-flow and the 3200-Re tests, while the eq. (10) check resulted in 3.5 μm and 1 μm for l_e, respectively. For the water/diesel (99.7/0.3) mixture, all three of the drain checks for the flushing data were also within ± 1.5 μm of the measurements that were made while the test fluid was flowing giving 0.5 μm and -0.5 μm, respectively. However, the agreement between the empty and filled test chamber tests was not as good for the water/diesel (99.7/0.3) mixture for the 7000-Re contamination measurements. For example, the air-gap check for the Re near 7000 condition produced a l_e near 5 μm, while the last measurement made with eq. (4) produced a l_e near 2 μm.

Flushing tests done after the water/diesel (99.8/0.2) 4800-Re contamination tests are shown in Fig. 8. The flushing measurements start at an l_e near 6.5 μm, which agrees with the value of l_e at the end of the 4600-Re contamination tests, thus, confirming the repeatability of the measurement technique. The l_e decreased from approximately 6.5 μm to approximately 1.5 μm after flushing for approximately 55 h. This corresponds roughly to a 0.09 μm/h removal rate and a 77 % reduction of the total diesel thickness over 55 h.

The flushing tests shown in Fig. 10 performed after the 5000-Re water/diesel (99.7/0.3) contamination tests, likewise start at approximately the same l_e (1.5 μm) as where the previous contamination test ended, again demonstrating good repeatability. After approximately 20 h of flushing, the 5000-Re contaminant thickness was reduced to approximately –0.5 nm. Given the uncertainty of the measurement, most all of the diesel has been removed by flushing with clean tap water. The removal rate achieved after the 5000-Re, 0.3 % mass fraction (3000 ppm) contamination tests (0.1 μm/h) agrees closely with that achieved for the flushing tests done after the 4600-Re, 0.2 % mass fraction (2000 ppm) contamination tests. This suggests a constant removal rate of approximately 0.1 μm/h of diesel from a copper surface for a flushing Re of 5000 that is independent of initial thickness and original contamination concentration. No removal rate could be calculated for the flushing tests done after the 7000-Re water/diesel (99.7/0.3) because the tests produced an l_e near –0.5 nm for nearly all measurement times.

Freundlich Constants

For sorption systems, the Freundlich constant (K) relates the equilibrium solid-phase concentration (c_s) to the equilibrium concentration of the bulk liquid-phase (c_l) as (Schwarzenbach et al., 2003):

$$c_s = K c_l^n \tag{12}$$

where the Freundlich exponent (n) determines the rate of sorption to the solid surface.

Equation 12 can be rewritten in terms of the excess surface density and the mass fraction of the bulk liquid as:

$$\Gamma = \frac{K}{a_s}\left(\frac{x_b \rho_b}{M_c}\right)^n = \hat{K}\left(x_b \rho_b\right)^n \tag{13}$$

where the constant a_s is the specific surface area of the solid defined as the surface area per mass of solid. Here K is normalized by the constant a_s and the molar mass of the contaminant raised to the n^{-1} power ($M_c^{n^{-1}}$) to give $\hat{K}$.

Because the present measurements do not sufficiently span the free stream concentration variable to accurately determine the Freundlich exponent, it was assumed that the diesel-water-copper system behaved as one with constant sorption free energies giving a linear isotherm with n = 1. Using this assumption, the normalized “Freundlich constants” were obtained by averaging measurements for a particular Re test for exposure times greater than 50 h in order to approach an equilibrium or steady state value for $\hat{K}$. All of the l_e measurements, for a given Re test, appeared to be nearly constant after 50 h of exposure. Consequently, it was assumed that a balance between diesel deposition and removal had been achieved.

Figure 12 shows the normalized Freundlich constant as a function of Re for the two different bulk concentrations of this study. The figure shows that $\hat{K}$ varies between near zero to values approaching 0.015 m. For Re less than 4000, the $\hat{K}$ behaves as expected with values for the 0.3 % bulk mass fraction being larger than those for the 0.2 % bulk mass fraction. However, for Re greater than 4000, the opposite behavior is observed, with $\hat{K}$'s for the 0.2 % mass fraction being larger than those for the 0.3 % mass fraction. Considering that a Re of 4000 is beyond the transition Re (from laminar to turbulent flow)[5] and within the transition region, no explanation can be offered at this time for the crossover phenomenon.

DISCUSSION

Because of its derivation from thermodynamics, the Freundlich constant given in eq. (12) is associated with chemical and/or physical equilibrium between the liquid-phase and the solid-phase concentrations. The measured phenomenon of the present study cannot be expressed in terms of a solid-phase concentration. The solid is not soluble with respect to the contaminant. Rather, the contaminant is located at the solid surface. As a result, the normalized "Freundlich constant" given by eq. (13) ($\hat{K}$) may not necessarily represent thermodynamic equilibrium. The $\hat{K}$ may be influenced by physical forces other than Van der Waals like flow and pressure forces. For this reason, the variation of the normalized Freundlich constant with respect to Re for fixed liquid-phase concentration is not prohibited by thermodynamics.

It is difficult to estimate the effect of the hydrolyzed diesel on the measurements, but it has likely introduced an unknown bias error to measurements. Future test with fresh diesel and water mixtures that have not had time to hydrolyze would reduce or eliminate the bias error.

CONCLUSIONS

A detailed account of the development of a fluorescence based measurement technique for measuring the mass of contaminant on solid surfaces in the presence of water flow has been provided. A test apparatus was designed and developed to use the fluorescent properties of diesel for the purpose of studying its adsorption and desorption to and from an oxidized copper test surface. A calibration technique was developed to measure both the mass of diesel adsorbed per unit surface area (the excess surface density) and the bulk concentration of the hydrolyzed diesel in the flow.

The measured diesel excess surface density that was adsorbed to the surface varied between zero and 0.02 kg/m^2 for Reynolds numbers between zero and 7000. A maximum for the diesel adsorption was observed near a Re of 4000 for both nominal bulk mass fractions of 0.2 % and 0.3 % diesel. For the most part, the thickness of the diesel excess surface density remained less than 10 μm. The exception to these excess layer measurements was the 0.3 % bulk mass fraction with Re = 4000 measurements that peaked near 25 μm.

In an effort to model the adsorption of diesel to copper, normalized Freundlich constants were calculated based on a linear isotherm and found to vary between near zero and 0.015 m.

[5] The transition Re would be 2300 if the hydraulic diameter concept prevails, and 3000 (Schlichting, 1979) if the flow is considered to be one between infinite flat plates.

Most of the Freundlich constants were less than 0.005 m. In addition, flushing tests suggest a constant removal rate of approximately 0.1 μm/h of diesel from a copper surface that is independent of initial thickness and original contamination concentration. The measurements show that most all of the diesel has been removed to within the uncertainty of the measurement procedure by flushing with clean tap water.

ACKNOWLEDGEMENTS
This work was funded by the U.S. Environmental Protection Agency (EPA) under contract #DW-13-92167701-0, with the guidance of project manager Mr. V. Gallardo. Thanks go to the following NIST personnel for their constructive criticism of the first draft of the manuscript: Dr. S. Treado, and Dr. P. Domanski. Thanks goes to the Mr. V. Gallardo of EPA for his constructive criticism of the second draft of the manuscript. Furthermore, the author extends appreciation to Mr. D. Wilmering for taking the measurements and conquering the difficult machining and design problems encountered in the project.

NOMENCLATURE

English Symbols

A	regression constants in eq. (5)
a_s	specific surface area, $m^2\ kg^{-1}$
c	concentration, mol m^{-3}
F	fluorescence intensity
F_r	raw fluorescence intensity measurement
I_o	incident intensity, V
K	Freundlich constant, mol·kg^{-1}
$\hat{K}$	normalized Freundlich constant, m
l	path length, m
l_e	thickness of excess layer, m
M_c	molar mass of contaminant, kg mol^{-1}
$\dot{m}$	mass flow rate, kg s^{-1}
Re	Reynolds number
n	Freundlich exponent
p_w	wetted perimeter of channel, m
T	temperature, K
U	expanded uncertainty
u_i	standard uncertainty
x	mass fraction of diesel

Greek symbols

β	coefficient of temperature dependence, K^{-1}
Γ	surface excess density, kg m^{-2}
ε	extinction coefficient
λ	wavelength, m
μ	dynamic viscosity, kg $m^{-1}\ s^{-1}$
ν	kinematic viscosity, $m^2\ s^{-1}$
ρ	mass density of liquid, kg m^{-3}
Φ	quantum efficiency of fluorescence

English Subscripts

0	zero reference jar
100	maximum reference jar
a	ambient
ag	air gap
b	bulk
d	pure diesel
e	excess layer
i	inlet
l	liquid
l_e	excess layer
m	emission, mixture
ng	no air gap
o	outlet or exit

s solid surface
T_b reference bath temperature
T_T test section temperature
x excitation
w tap water

Superscripts
\- average

REFERENCES

Amadeo, J. P., Rosén C., and Pasby, T. L., 1971, Fluorescence Spectroscopy An Introduction for Biology and Medicine, Marcel Dekker, Inc., New York, p. 153.

Guilbault, G. G., 1967, Fluorescence: Theory, Instrumentation, and Practice, Edward Arnold LTD., London, pp. 91-95.

Herman, B., 1998, Fluorescence Microscopy, 2nd ed., Springer-Verlag New York, Inc., pp. 69 –71.

Kedzierski, M. A., 2003, "Effect of Bulk Lubricant Concentration on the Excess Surface Density During R134a Pool Boiling with Extensive Measurement and Analysis Details," NISTIR 7051, U.S. Department of Commerce, Washington, D.C.

Kedzierski, M. A., 2002, "Use of Fluorescence to Measure the Lubricant Excess Surface Density During Pool Boiling," Int. J. Refrigeration, Vol. 25, pp.1110-1122.

Kedzierski, M. A., 2001, "Use of Fluorescence to Measure the Lubricant Excess Surface Density During Pool Boiling," NISTIR 6727, U.S. Department of Commerce, Washington, D.C.

Miller, J. N., 1981, Volume Two Standards in Fluorescence Spectrometry, Chapman and Hall, London, pp. 44-67.

Reader, J, Corliss, C. H., Wiese, W. L., and Martin, G. A., 1980, "Wavelengths and Transition Probabilities of Atoms and Atomic Ions", NSRDS-National Bureau of Standards #68, U.S. Department of Commerce, Washington.

Schlichting, H., 1979, Boundary-Layer Theory, McGraw-Hill, New York, pg. 591.

Schwarzenbach, R. P., Gschwend, P. M., and Imboden, D., M., 2003, Environmental Organic Chemistry, 2nd ed., Wiley, NJ, pp 281-283.

Simplex, 2006, http://www.simplexdirect.com/FuelSupply/mainten04.html

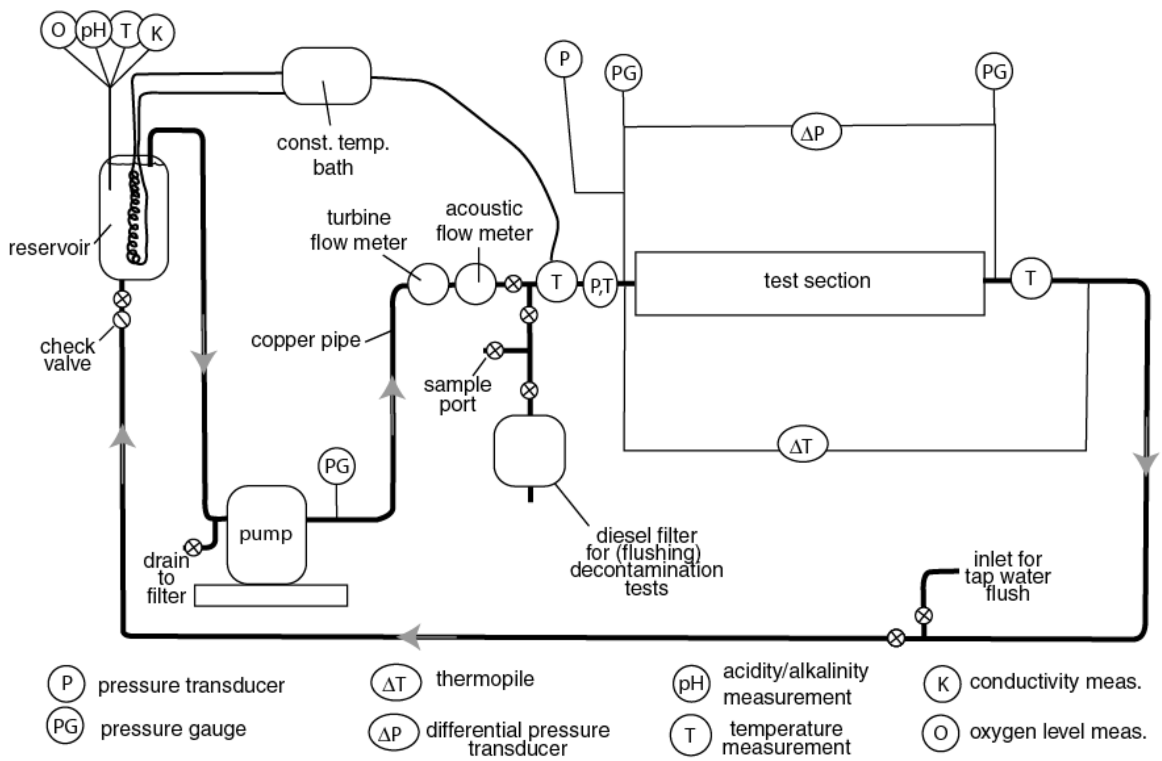

Fig. 1 Schematic of test loop

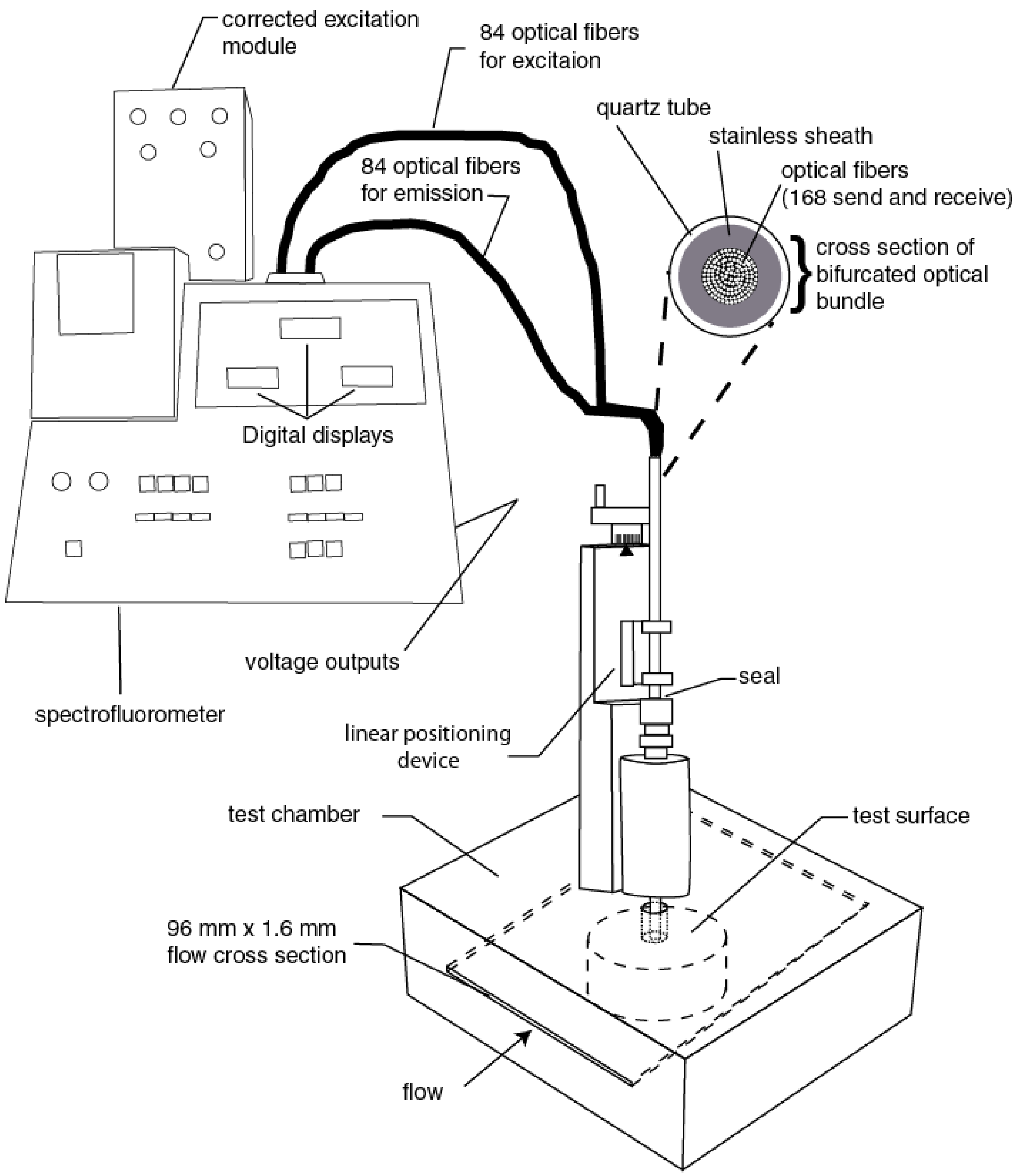

Fig. 2 Schematic of spectrofluorometer, test section, and linear positioning device

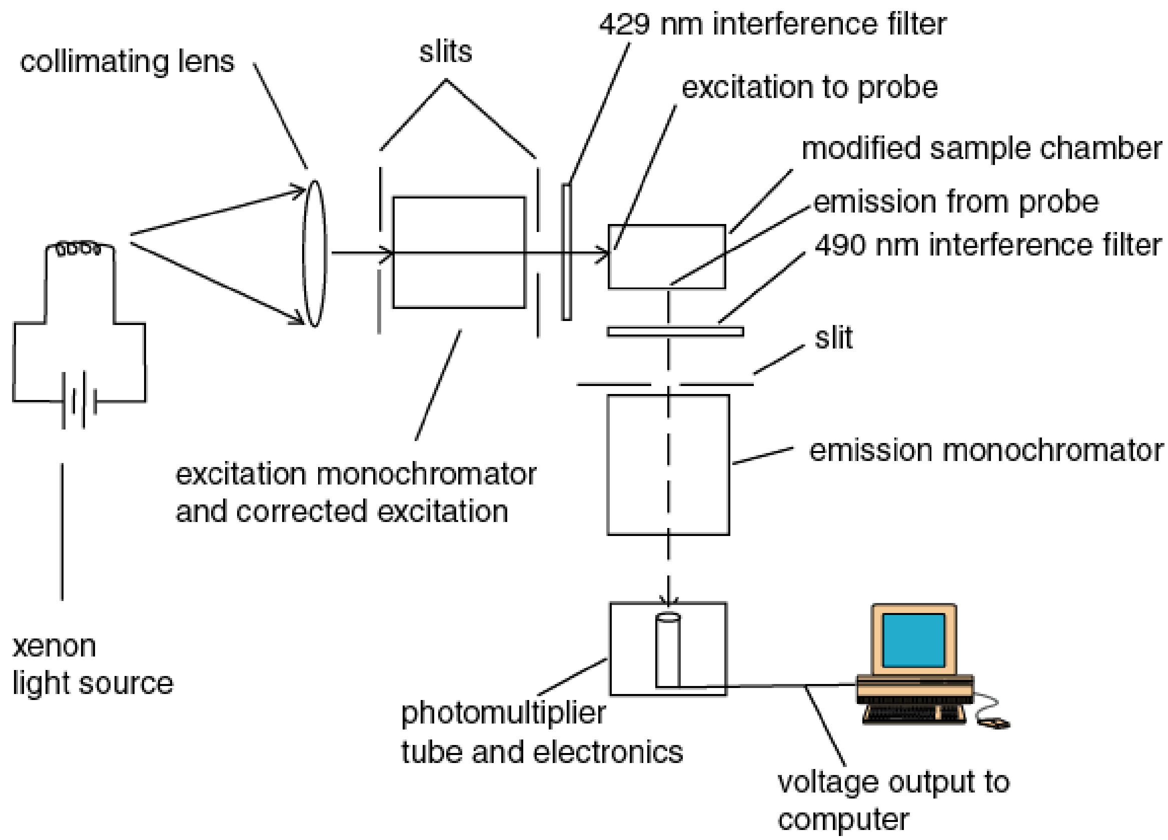

Fig. 3 Schematic of right angle spectrofluorometer

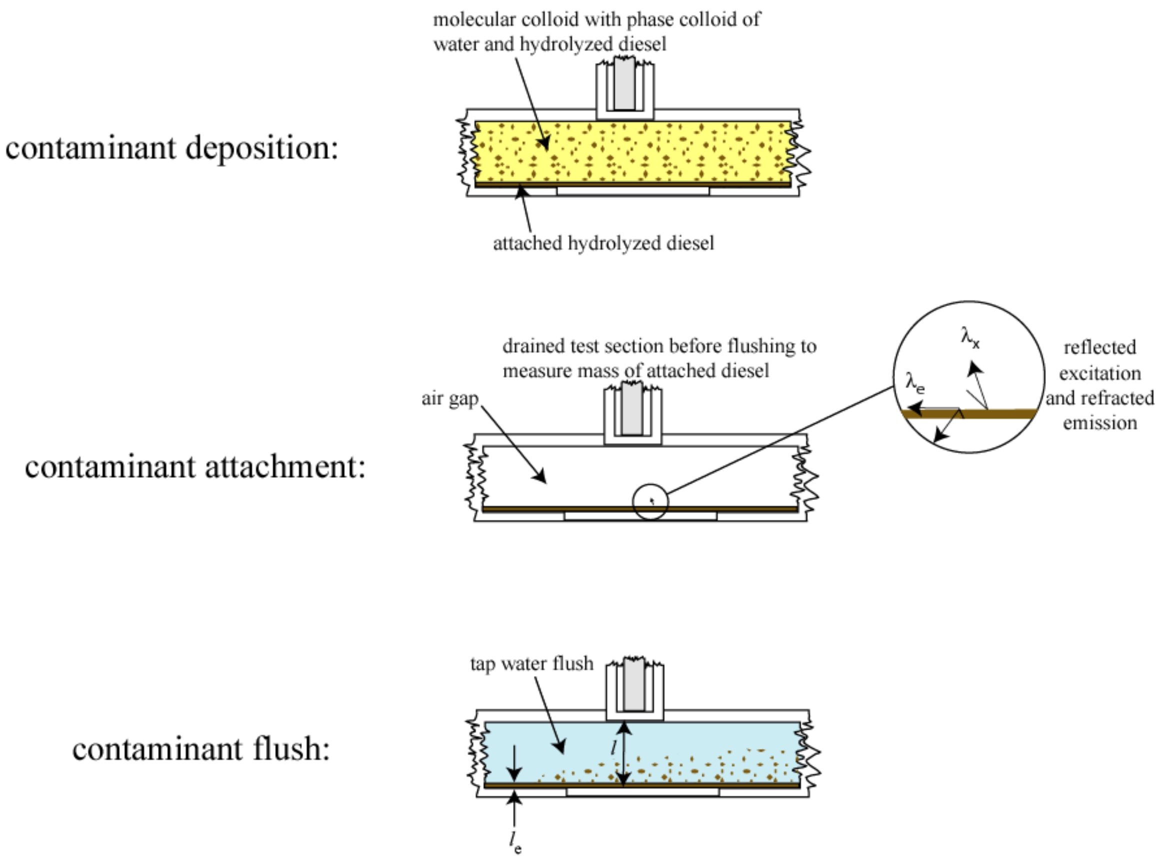

Fig. 4 Cross-sectional illustration of test section during contamination and flushing

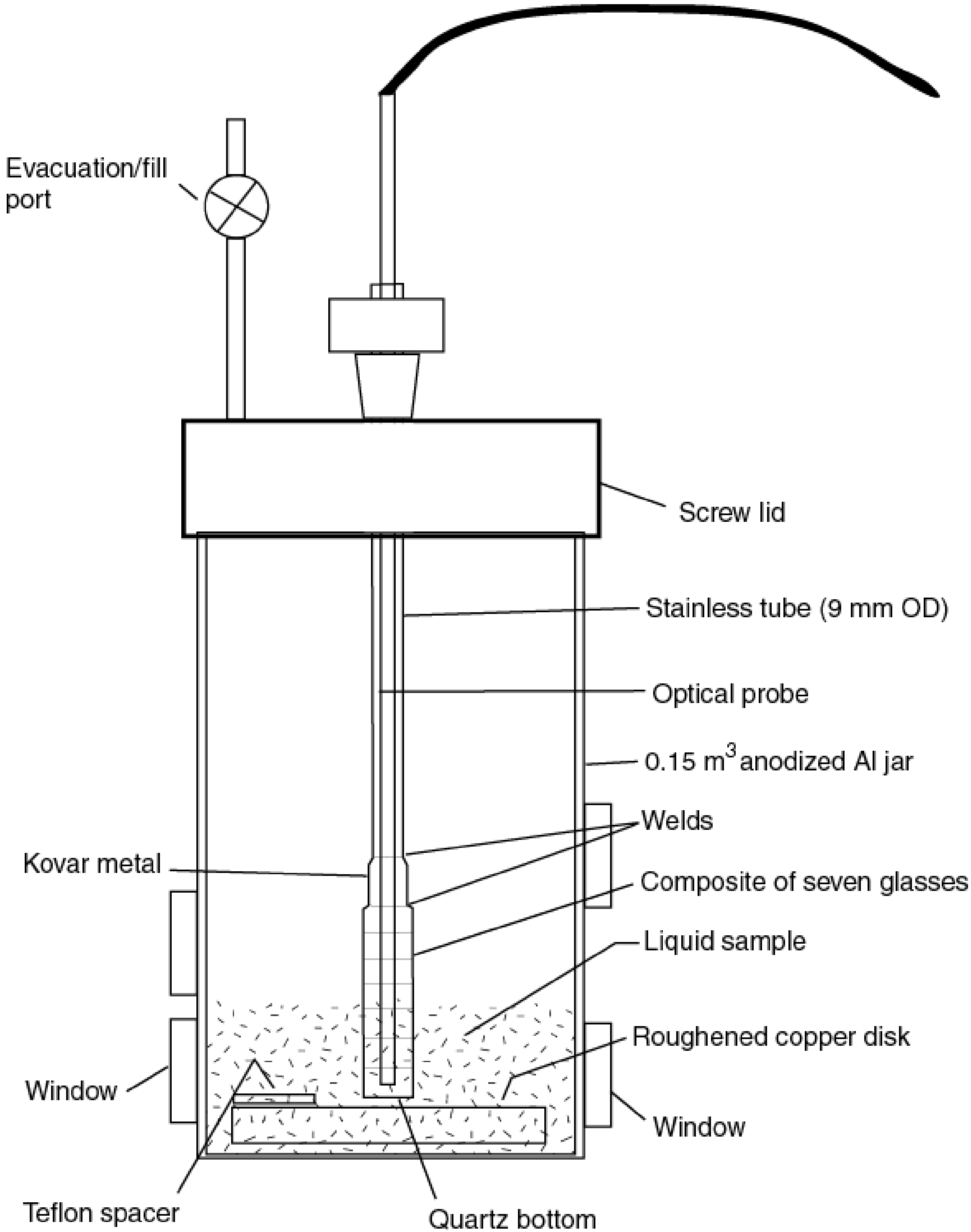

Fig. 5 Schematic of fluorescence/composition calibration jar

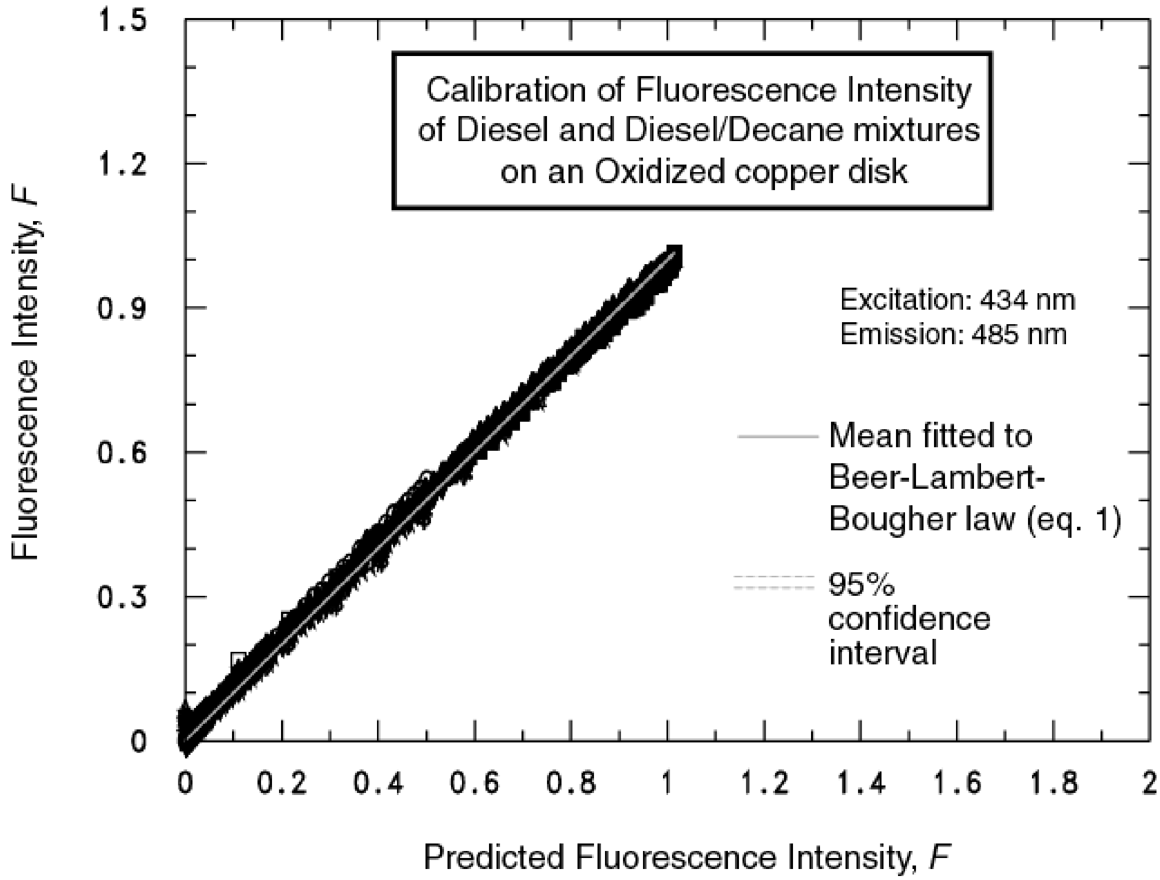

Fig. 6 Overall calibration of Beer-Lambert Bougher law for diesel on copper disk

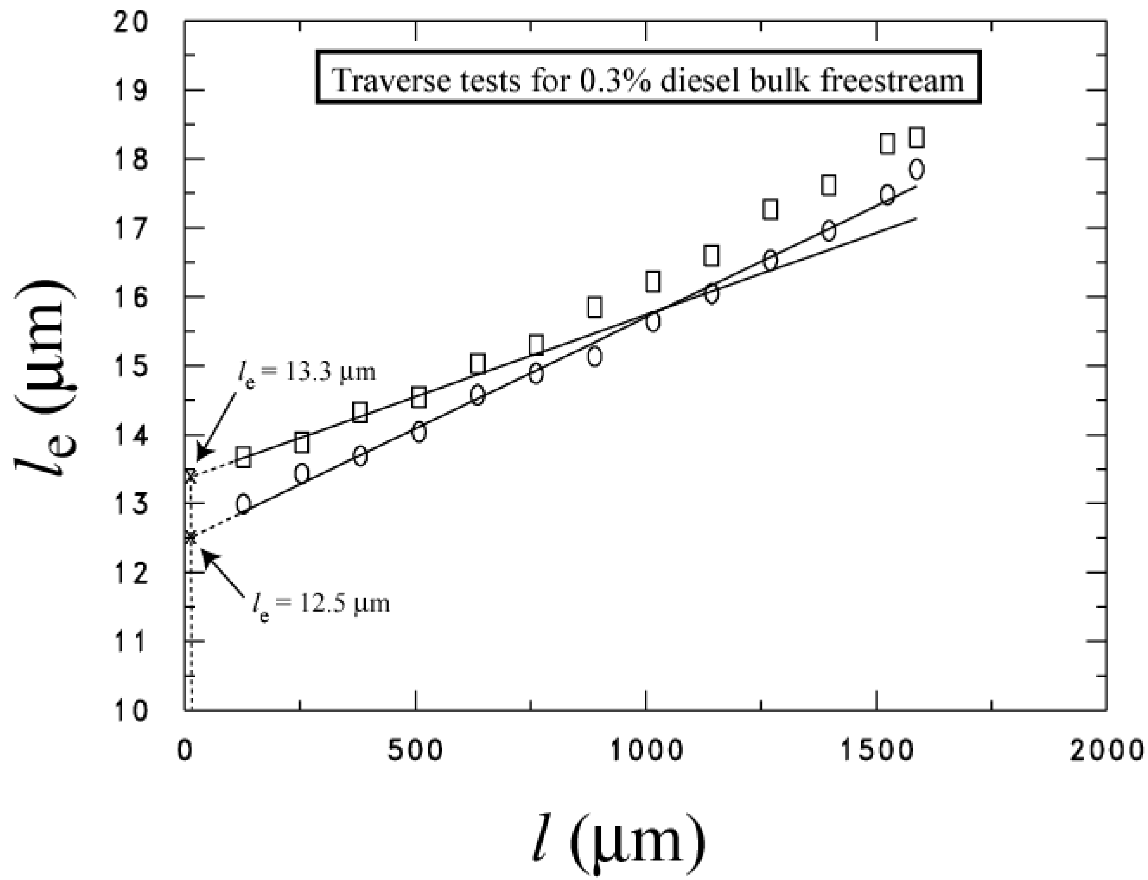

Fig. 7 Demonstration of excess layer thickness measurement

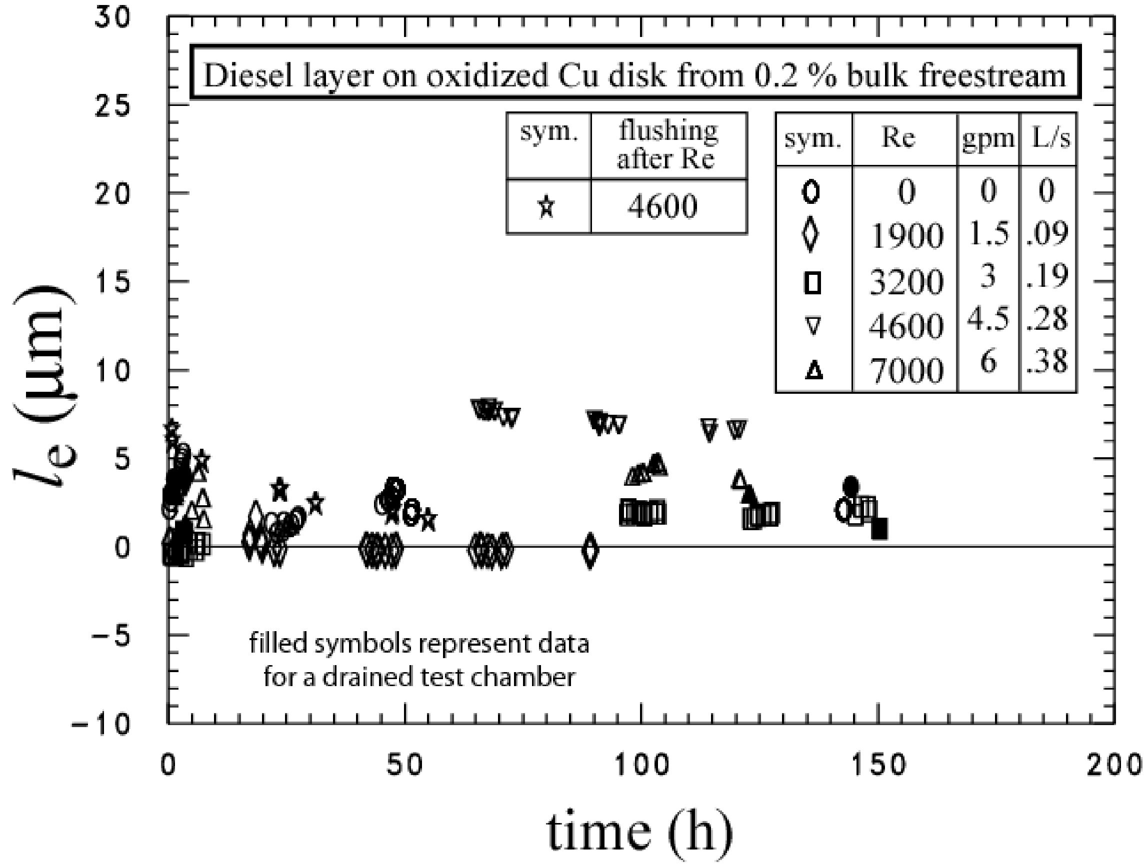

Fig. 8 Effect of exposure time and flow rate on thickness of the diesel excess layer for a 0.2 % bulk freestream mass fraction

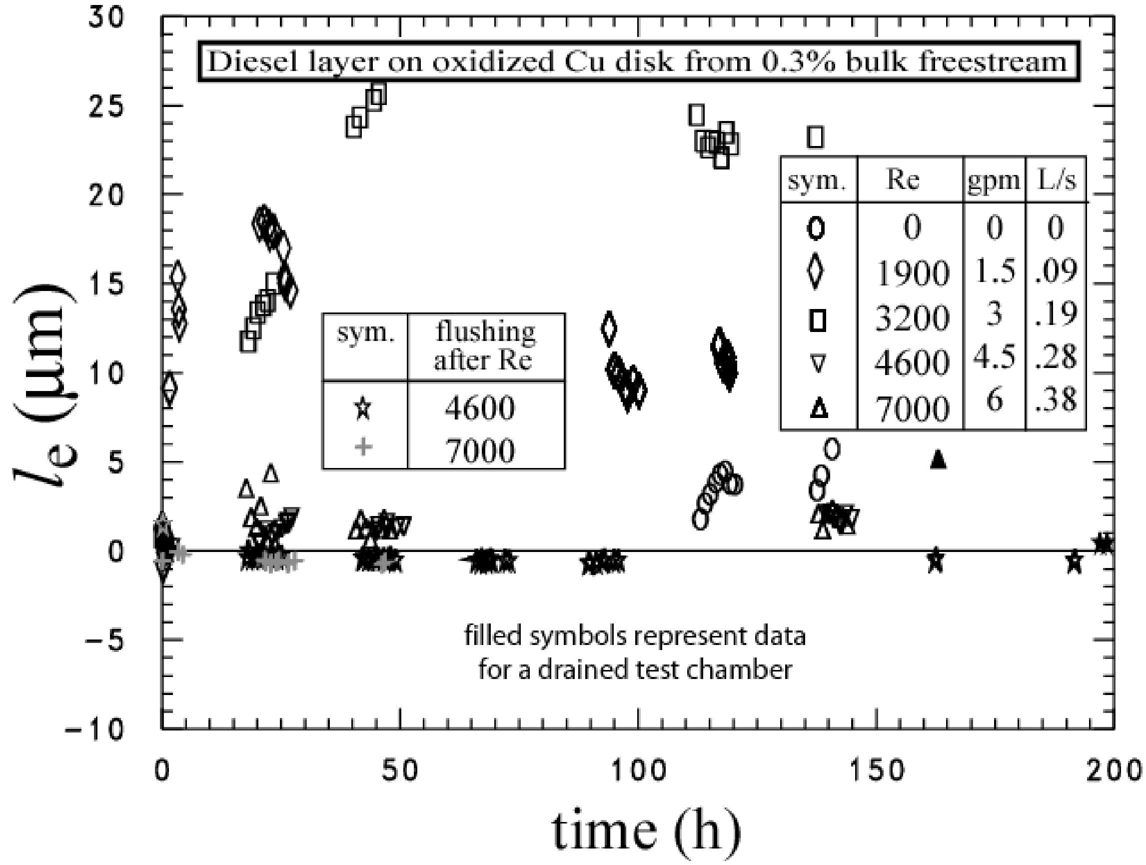

Fig. 9 Effect of exposure time and flow rate on thickness of the diesel excess layer for a 0.3 % bulk freestream mass fraction

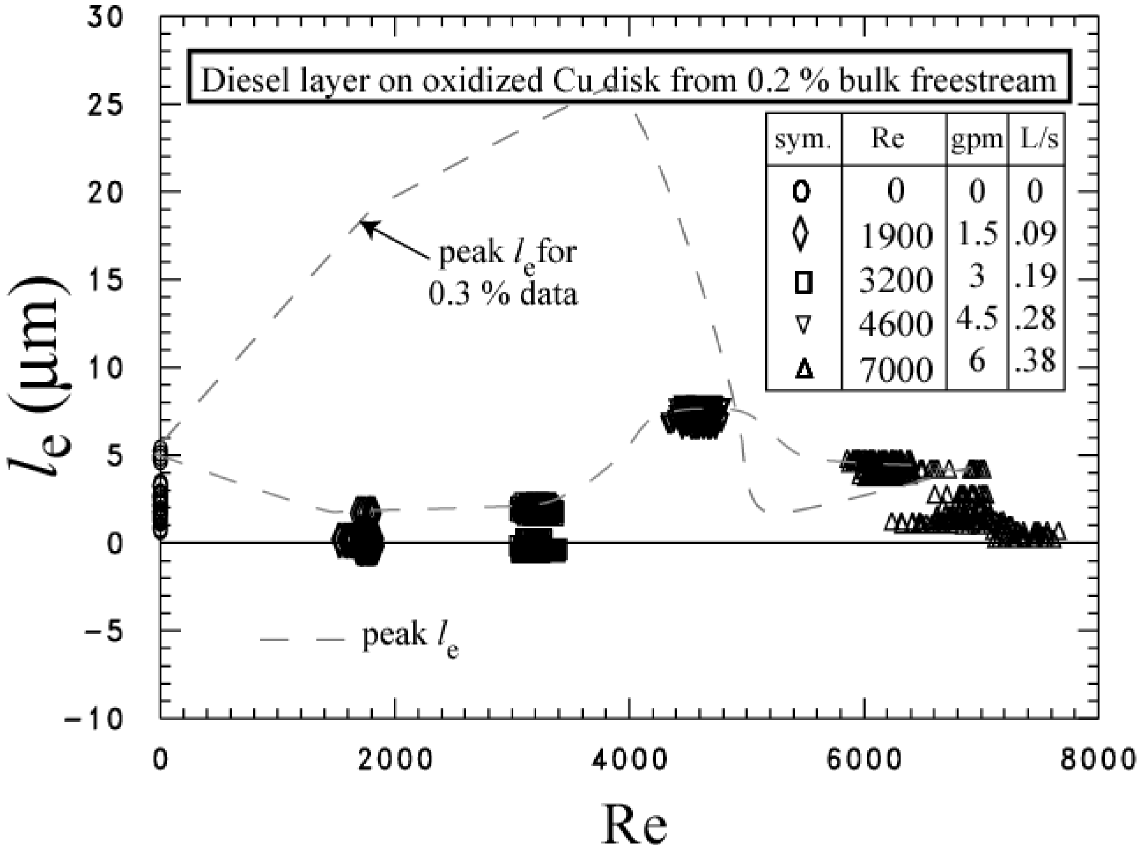

Fig. 10 Diesel excess layer thickness as a function of Re for water/diesel (99.8/0.2)

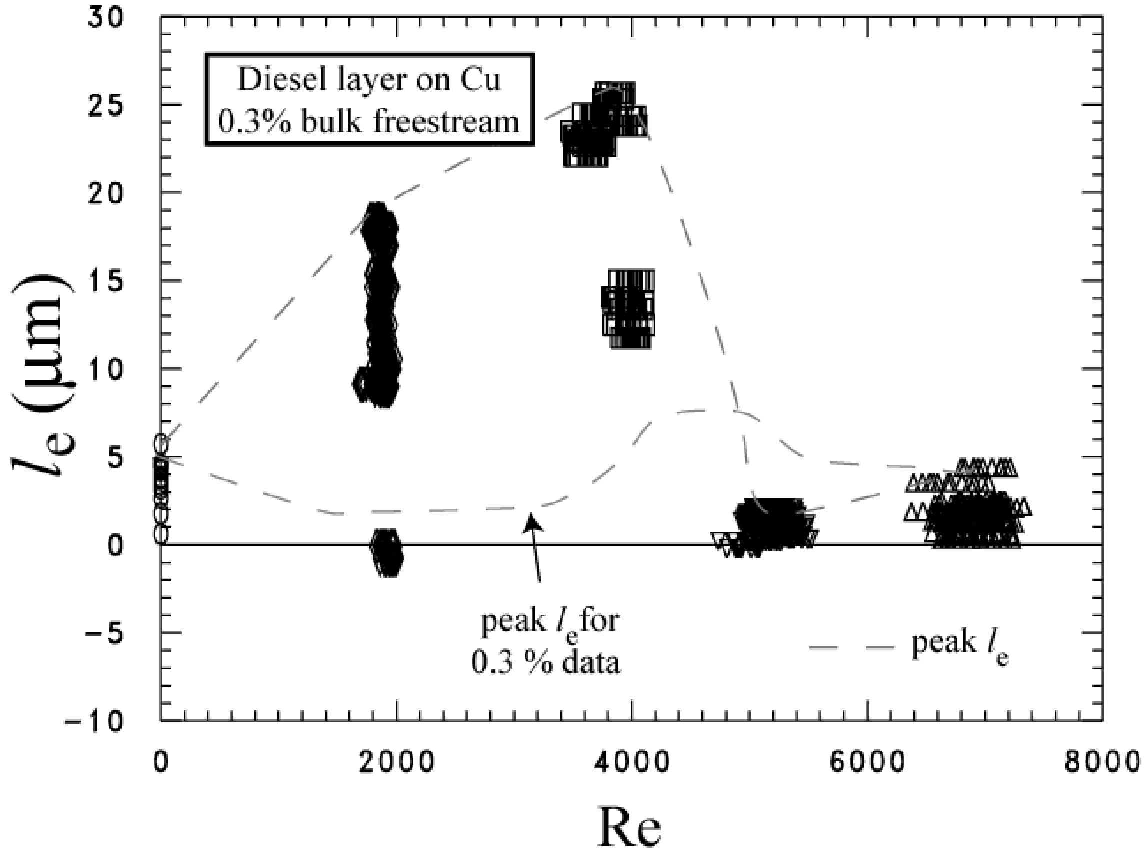

Fig. 11 Diesel excess layer thickness as a function of Re for water/diesel (99.7/0.3)

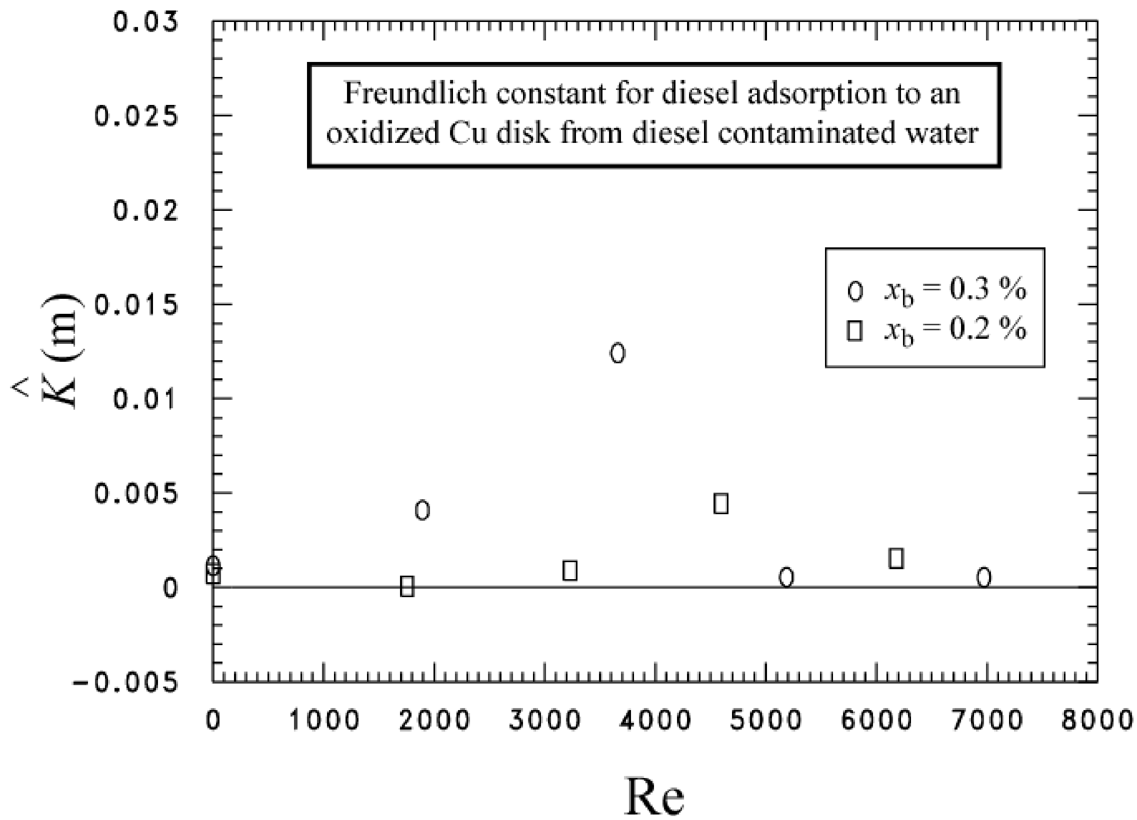

Fig. 12 Normalized Fruendlich constants for diesel adsorption to an oxidized Cu disk from diesel contaminated water

APPENDIX A: EXCITATION AND EMISSION WAVELENGTHS

Appendix A describes the methodology used to select the excitation and emission wavelengths to ensure that a significant and measurable emission signal was obtained with no measurable overlap of the excitation and emission spectra.

The wavelengths for the excitation and emission light that gave the best compromise between emission intensity strength with minimal interference from the excitation were chosen based on the following analysis. Figure A.1 shows the analysis of the emission and excitation spectra of pure diesel in a cuvette. The test sample was placed directly in the sample chamber of the right angle spectrofluorometer. The excitation wavelength that produced the maximum fluorescence emission was iteratively found by scanning through both excitation and emission wavelengths. The excitation and emission wavelengths for diesel that produced the largest intensities were located approximately at 451 nm and 484 nm, respectively.

It is immediately apparent that filtering of both the excitation and the emission is required to reduce the overlap of the two spectra. Because of the parallel light configuration of the probe incident to the test surface, both excitation and emission light will be introduced to the detector if the light is not filtered. A 429 nm bandpass filter was chosen to filter the excitation before it got to the test surface. And a 490 nm bandpass filter was used to filter the emission intensity before it was sent to the detector. Figure A.2 shows the filtered spectra from the optical probe in a jar of diesel. The filtering process as successfully separated the emission and excitation peaks (485 nm and 435 nm, respectively) and removed the overlap of the two spectra. Because the interference filters have a finite bandwidth, an excitation filter centered at 450 nm would have resulted in some overlapping of the spectra. For this reason, a smaller wavelength was chosen for the excitation signal.

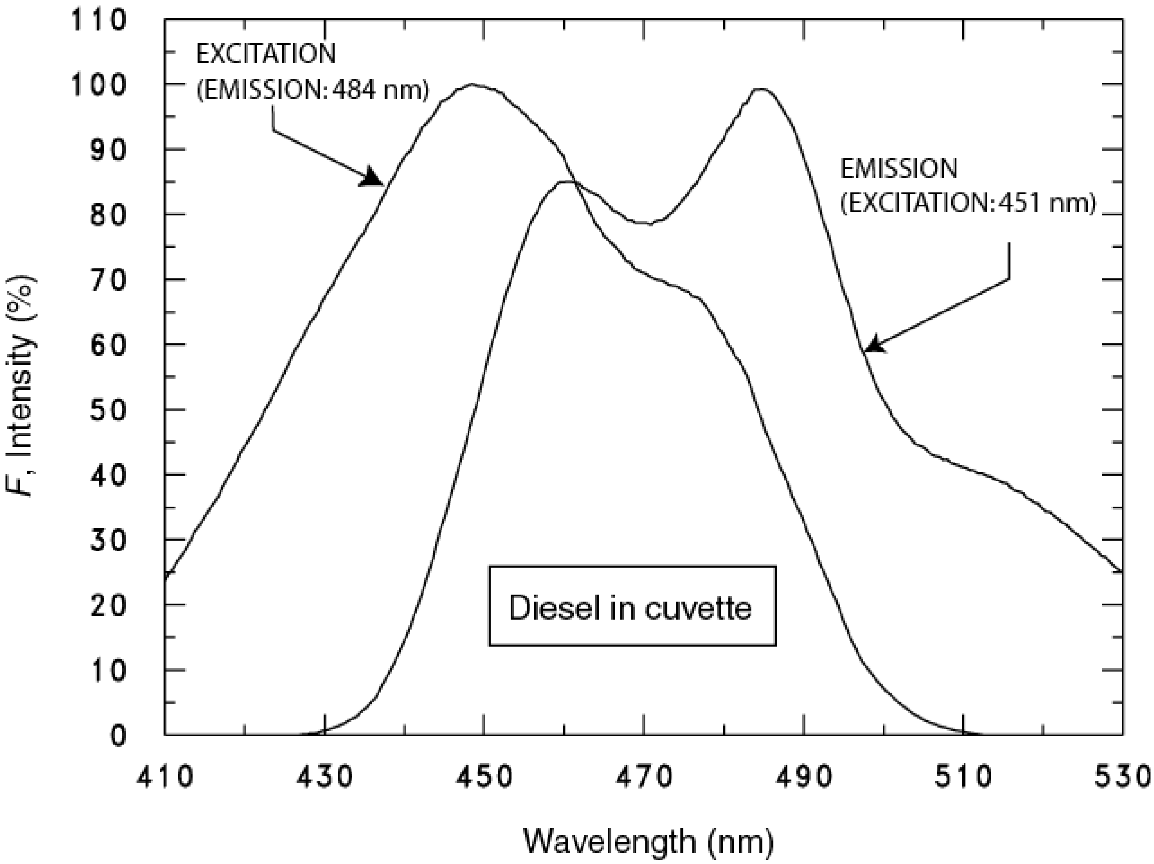

Fig. A.1 Emission and excitation spectra for diesel

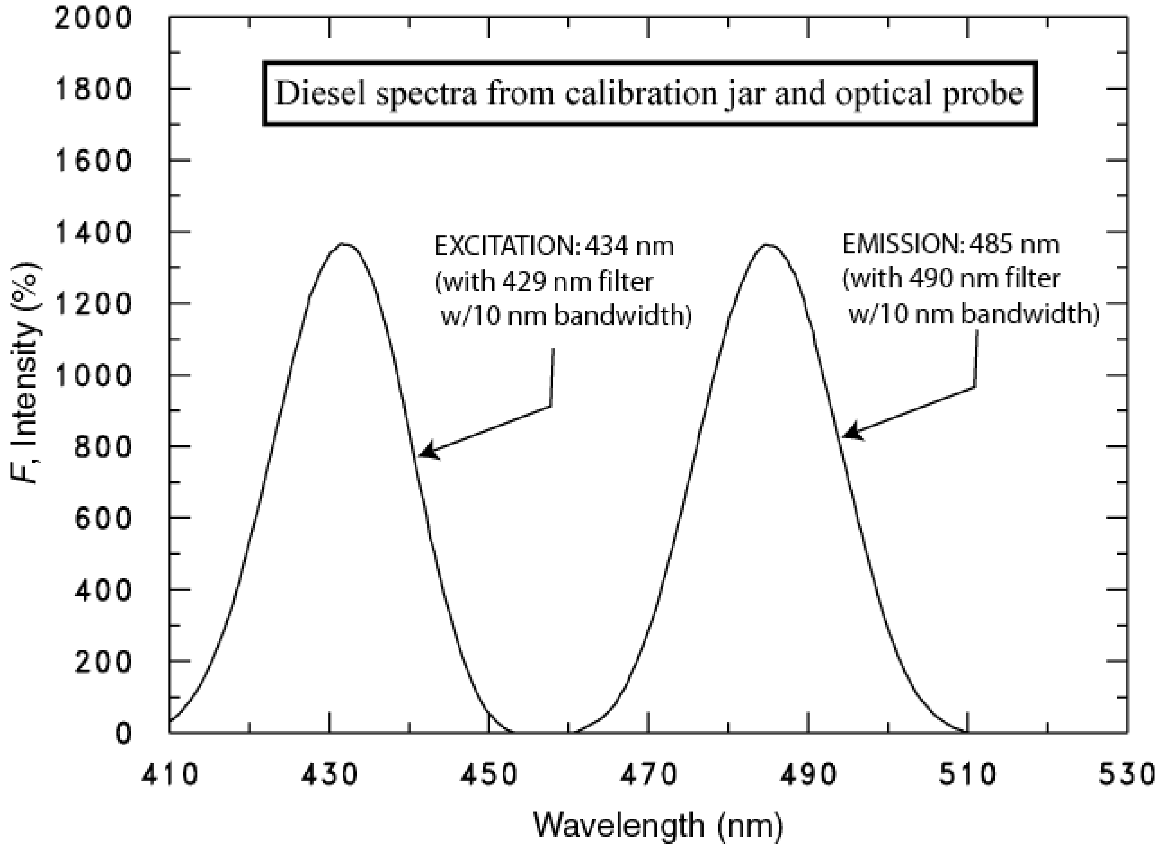

Fig. A.2 Filtered excitation and emission spectra for diesel

APPENDIX B: DIESEL PROPERTIES

This appendix presents the measurements and the correlation of the density (ρ_d) and the kinematic viscosity (ν_d) for the liquid #2 diesel fuel used in this experiment.

Liquid Density

The density of the liquid diesel was measured as a function of temperature with a glass pycnometer. The pycnometer was factory instrumented with a glass mercury thermometer with a range of 14°C to 38°C in 0.2° graduations, accurate to within ± 0.2 K. The pycnometer was filled with distilled water and its volume was calculated from the known density of water. The volume was found over five trails to be 9.84 mL with a standard uncertainty of 0.01 mL.

The pycnometer containing diesel was cooled in an ice bath and then removed from the bath and allowed to warm on the balance to room temperature over approximately one hour. The standard uncertainty of the balance was approximately 1 mg. The outside of the pycnometer was wiped clean before each measurement to remove the diesel that was expelled through the pipette due to volume expansion with temperature increase.

The Biot number for the warming pycnometer was estimated to be approximately 0.5, which is greater than the recommended limit of 0.1 (Incropera and Dewitt, 1985) for a uniform temperature in fluid. It is difficult to estimate the error introduced in the measurements due to temperature gradients that existed in the diesel. However, the data regression shows that the residuals are independent of temperature, which suggests that the error due to temperature gradients in the liquid had a negligible effect on the density measurements.

Table B.1 shows the recorded measurements for two days. Equation B.1 gives the fit of the liquid diesel density (ρ_d) in kg/m^3 versus temperature (T) in Kelvin:

$$\rho_d = 1056.29 - 0.700T \qquad \text{B.1}$$

The expanded uncertainty of the fit was approximately ± 0.2 kg/m^3 for 95 % confidence.

Kinematic Viscosity

The kinematic viscosity of the liquid diesel (ν_d) was measured at room temperature (approximately 297.6 K) with a glass viscometer and found to be 3.93 μm^2/s ± 0.024 μm^2/s. Kinematic viscosity measurements from Simplex (2006) for #2 diesel fuel shown in Table B.2 were used to obtain the trend of viscosity with respect to temperature. This was done by using the same slope of the linear $\ln \nu$ versus T^{-1} fit for the Simplex (2006) data with an intercept that reproduced our single viscosity measurement. The following correlation reproduces the single room temperature value for our batch of diesel and temperature dependence of the Simplex (2006) diesel data:

$$\nu_d (m^2/s) = 4.434 \times 10^{-9} e^{2020.17/T(K)} \qquad \text{(B.2)}$$

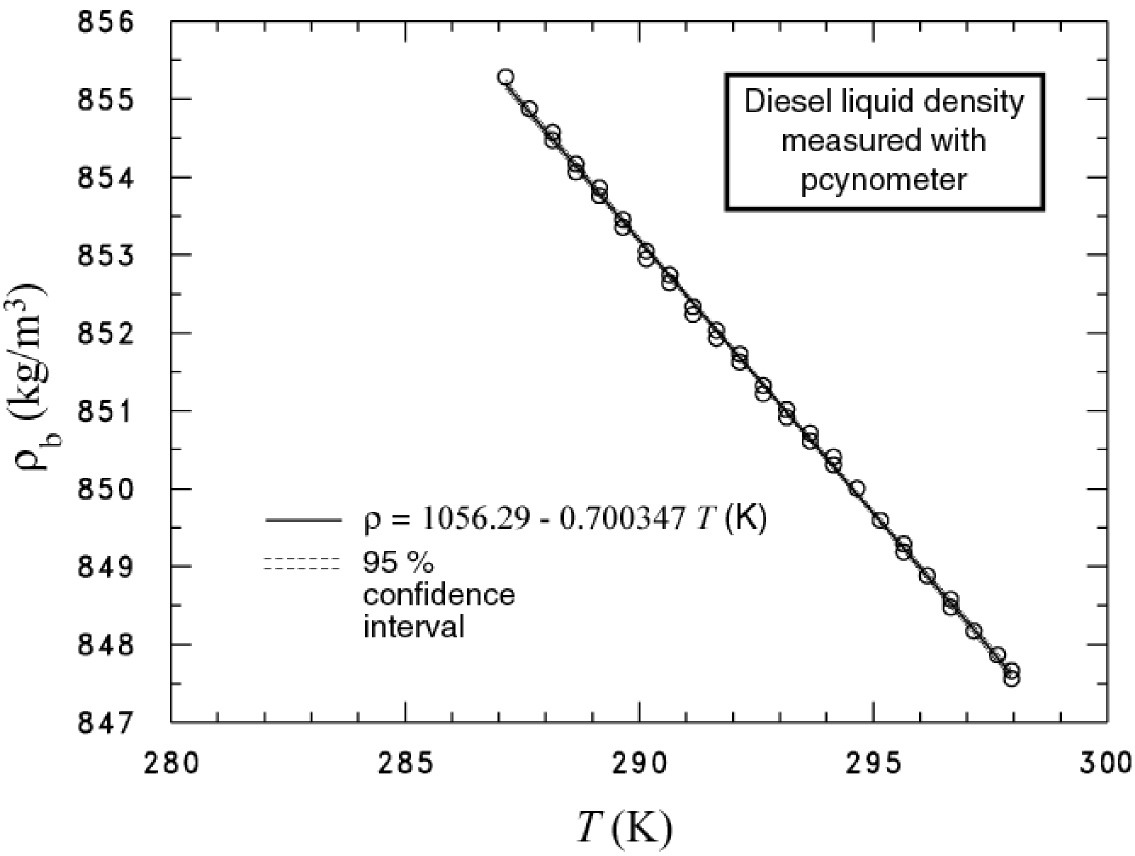

Fig. B.1 Measured liquid density of diesel and fit

Table B.1 Diesel liquid density measurements (file:DieDen.dat)

T (°C)	T (K)	diesel mass (g)	ρ_d (kg/m^3)
14.00	287.15	8.42	855.28
14.50	287.65	8.41	854.88
15.00	288.15	8.41	854.57
15.50	288.65	8.40	854.17
16.00	289.15	8.40	853.86
16.50	289.65	8.40	853.46
17.00	290.15	8.39	853.05
17.50	290.65	8.39	852.74
18.00	291.15	8.39	852.34
18.50	291.65	8.38	852.03
19.00	292.15	8.38	851.73
19.50	292.65	8.38	851.32
20.00	293.15	8.37	851.02
20.50	293.65	8.37	850.71
21.00	294.15	8.37	850.41
21.50	294.65	8.36	850.00
22.00	295.15	8.36	849.59
22.50	295.65	8.36	849.29
23.00	296.15	8.35	848.88
23.50	296.65	8.35	848.48
24.00	297.15	8.35	848.17
24.50	297.65	8.34	847.87
24.80	297.95	8.34	847.66
14.00	287.15	8.42	855.28
14.50	287.65	8.41	854.88
15.00	288.15	8.41	854.47
15.50	288.65	8.40	854.06
16.00	289.15	8.40	853.76
16.50	289.65	8.40	853.35
17.00	290.15	8.39	852.95
17.50	290.65	8.39	852.64
18.00	291.15	8.39	852.24
18.50	291.65	8.38	851.93
19.00	292.15	8.38	851.63
19.50	292.65	8.38	851.22
20.00	293.15	8.37	850.91
20.50	293.65	8.37	850.61
21.00	294.15	8.37	850.30
21.50	294.65	8.36	850.00
22.00	295.15	8.36	849.59
22.50	295.65	8.36	849.19
23.00	296.15	8.35	848.88
23.50	296.65	8.35	848.58
24.00	297.15	8.35	848.17
24.50	297.65	8.34	847.87
24.80	297.95	8.34	847.56

Table B.2 Diesel #2 liquid kinematic viscosity measurements (Simplex, 2006)

T (º F)	T (K)	ν_d (SUS)	ν_d (μm^2/s)
30	272.04	138	27.6
60	288.71	70	14
80	299.82	53.6	10.72
100	310.93	45.5	9.1
130	327.59	39	7.8

APPENDIX C: HYDROLYZED DIESEL

Figure C.1 compares the fluorescent emission spectrum for pure diesel to that of the hydrolyzed diesel in water mixture as taken from the reservoir of the test chamber. Both fluids where excited in quartz cuvettes at a wavelength of 451 nm with 2.5 nm slits in the spectrofluorometer. The fluid from the test reservoir was mostly the bulk phase of the water where the hydrolyzed diesel was stably suspension within the bulk water and at approximately 0.15 % mass fraction of diesel. The mass fraction was determined from the relative peak intensities of the reservoir fluid to that of the pure diesel for these cuvette tests. No interference filters were used in the sample chamber of the spectrofluorometer. Evidence for a chemical breakdown of the diesel is based on the fact that the peak fluorescence emission for the emulsified water diesel exists at a wavelength that is 25 nm greater than that of pure diesel.

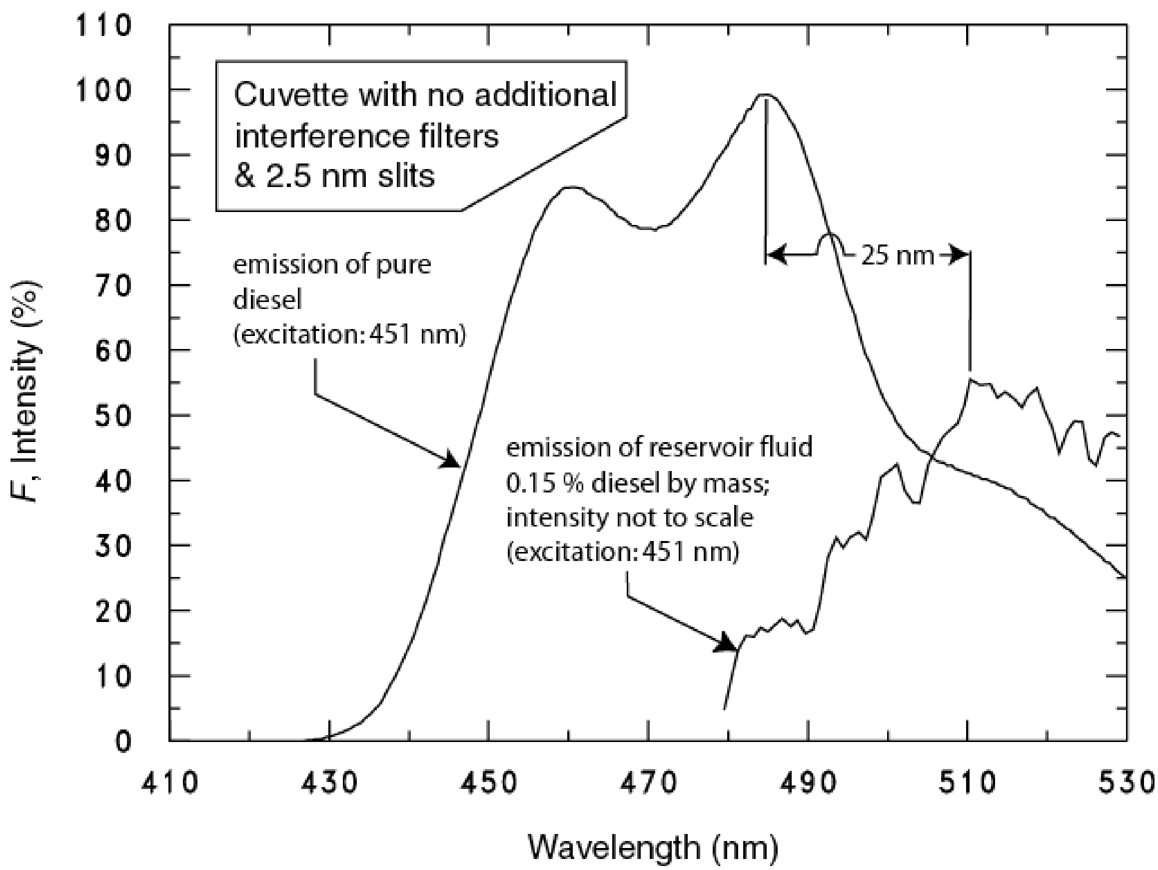

Fig. C.1 Fluorescent emission spectra for pure diesel and hydrolyzed reservoir test fluid

APPENDIX D: FLUORESCENT TEMPERATURE DEPENDENCE

This appendix presents the measurements and the methodology that were used to determine the coefficient of temperature dependence (β) for the fluorescent intensity of diesel (Kedzierski, 2003). All of the measurements and settings were made with the excitation set to 434 nm and the emission measured at 485 nm with the additional spectrofluorometer filters in place as described in Appendix A. Pure diesel was cooled from nominally 303 K to 279 K for two sets of 500 measurements in a temperature controlled liquid bath. The temperature of the mixture was measured with a sheathed thermocouple that was in the controlled temperature bath with the maximum- and zero-jars. The fluorescence intensity of the maximum-jar as a function of bath temperature is given in Fig. D.1.

The temperature dependence of the fluorescence can be expressed as the ratio of the fluorescence intensity at the bath temperature (F_{T_b}) to the intensity evaluated at the test section temperature (F_{T_T}) for all other variables held constant (Kedzierski, 2003):

$$\frac{F_{T_b}}{F_{T_T}} = e^{\beta(T_b - T_T)} \qquad \text{(D.1)}$$

where the coefficient of temperature dependence of the fluorescence (β) was found to be approximately 0.00156 for the diesel data set shown in Fig. D.1.

Equation D.1 is used to account for any difference between the temperature of the bath that holds the fluorescent standard jars and the temperature of the test section. The target test section fluid temperature for the contamination tests is the same as the fluorescent standard bath temperature. As a result, for approximately 85 % of the contamination measurements, the test section temperature differed no more than ± 1 K from the bath temperature, which would have resulted in an adjustment in the fluorescence with eq. (D.1) by no more than ± 0.2 %. The largest difference between the temperature of the jar bath and the average temperature of the test section for the contamination tests was approximately 4.5 K, which corresponds to a 0.3 % correction of the fluorescence intensity. Flushing tests required larger corrections via eq. (D.1). Flushing was done with house tap water that was as much as 10 K colder than the jar bath temperature, which resulted in a maximum correction of 1.5 % of the fluorescence intensity.

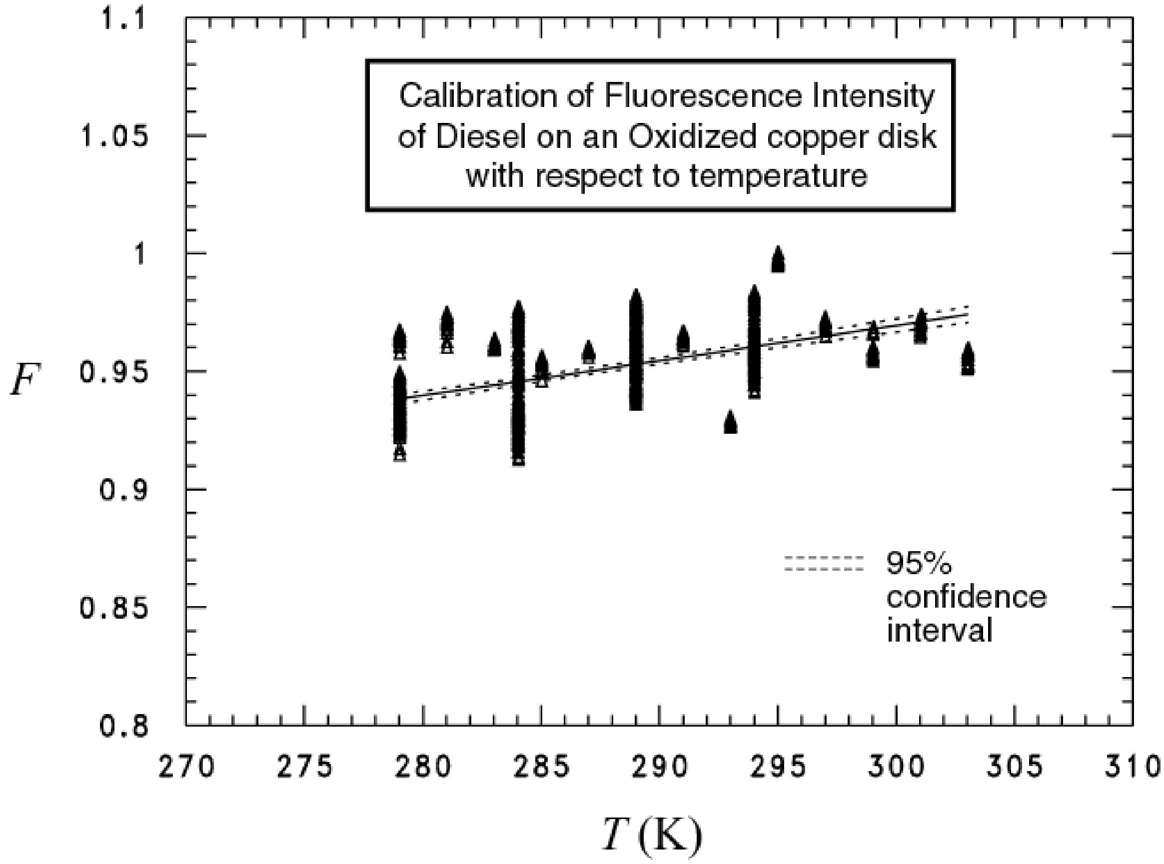

Fig. D.1 Temperature dependence of diesel fluorescence

APPENDIX E: FLUORESCENCE CALIBRATION

This appendix provides more detail on the procedure that was developed and used to calibrate the fluorescence intensity of diesel against mass fraction, path length, air gap, and fluid properties. All calibration measurements were done on a copper disk that was flattened from a pipe and evenly oxidized by electrolysis. Appendix I shows how the functionality of the spectrofluorometer was verified.

Figure E.1 shows the calibration of the fluorescence intensity of diesel against diesel mass fraction for fixed path length. The temperature of the diesel in the 150 mL calibration jar (shown in Fig. 6) was held constant at approximately 294 K. The diesel was mixed with non-fluorescent n-decane in order to dilute the diesel to the desired mass fraction. Unlike water, n-decane was miscible with diesel. The distance between the top of the calibration disk and the bottom of the quartz tube (the path length) was set and fixed with the aid of a 1.6 mm gauge block. For these conditions, the fluorescence intensity was fitted linearly with respect to the diesel mass fraction to within a residual standard deviation of ± 1.2 %.

Figure E.2 shows the calibration of the fluorescence intensity of diesel against the path length through the diesel for neat diesel (for fixed $x_b = 1$). As in the previous mass fraction calibration described above, the temperature of the diesel was held constant at approximately 294 K. This second calibration method was used to determine the effect of the proximity of the incident light (I_o) via changing its path length (*l*). As shown in Fig. 2, a linear positioning device with a graduated knob was used to locate the quartz tube relative to the test surface and thus measure and set the path length of the incident light through the diesel. The measured fluorescent intensity versus the path length was non-linear as shown in Fig. E.2. The calibrations given in Figs. E.1 and E.2 were combined with an exponential representation of I_o as a function of *l* to give the total calibration as given in eq. (4).

Figure E.3 shows the calibration measurements that were used to determine the effect of an air gap above the test surface. This method served as a secondary measurement check because it was desired to have a technique that did not require the test section to be filled with test fluid. Because of the mismatch in the index of refraction between the quartz, the air, and the diesel film, the intensity incident to the diesel for when an air-gap existed differed from that for when fluid filled the space between the test surface and the bottom of the quartz probe. To determine the effect of incident intensity reflections from interfaces exposed by the air gap, the probe was traversed above a diesel film of fixed thickness. Because the amount of fluorescent material remained fixed for these tests, the magnitude of the measured intensity was attributed to change in the magnitude of the incident intensity due to it proximity to the diesel film.

Figure E.3. shows measurements with and with out air gaps below the quartz probe. As expected, measurements with no air gap are shown to lie on the eq. (4) calibration. Measurements taken with an air gap reside to the right of the eq. (4) calibration in a stratum of nearly linear data grouped by different diesel film thickness. For these measurements, the intensity is shown to increase slightly has the probe approaches the diesel film. From the air-gap data, it was observed that $\frac{1}{F}\frac{dF}{dl}$ was approximately constant for all ranges of the *F* and *l* traverse data for each group of fixed diesel film thickness. The value of F used in this product for each group was extrapolated to the calibration line for no-air-gap (F_{ng}). The gradient was calculated using the air-gap measurements, i.e., $\frac{dF_{ag}}{dl}$. The average ratio between F_{ng} and the air-gap gradient for all the groups was:

$$\frac{1}{F_{ng}}\frac{dF_{ag}}{dl} = -82.57\mathrm{m}^{-1} \tag{E.1}$$

From the integration of eq. (E.1) it can be seen that the dependency of the intensity is exponential with path length. Considering that this dependency represents how I_o changes with proximity to the test surface, an exponential term with respect to path length was used to represent I_o in the full calibration eq. (4).

The diesel film thickness using the air-gap fluorescent gradient can be solved for by substituting eq. (4) into eq. (E.1) for the F_{ng}:

$$l_e = \frac{-0.0121\mathrm{m}\frac{dF_{\mathrm{ag}}}{dl}}{2.3I_o\Phi\varepsilon M_{\mathrm{c}}^{-1}} = \frac{-0.0115\mathrm{m}^{-1}\mathrm{kg}\frac{dF_{\mathrm{ag}}}{dl}e^{209.23\mathrm{m}^{-1}l}}{x_{\mathrm{b}}\rho_{\mathrm{b}}} \tag{E.2}$$

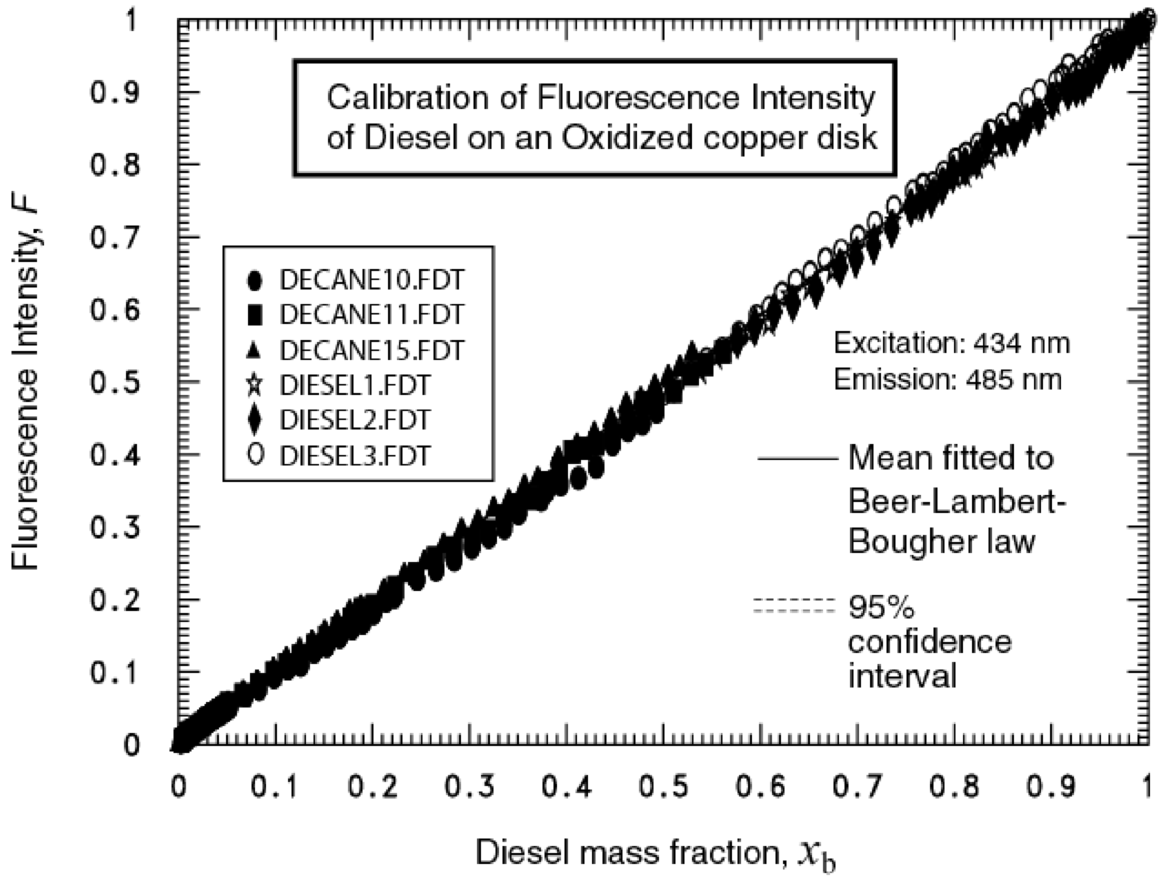

Fig. E.1 Calibration of diesel fluorescence against diesel mass fraction for different runs

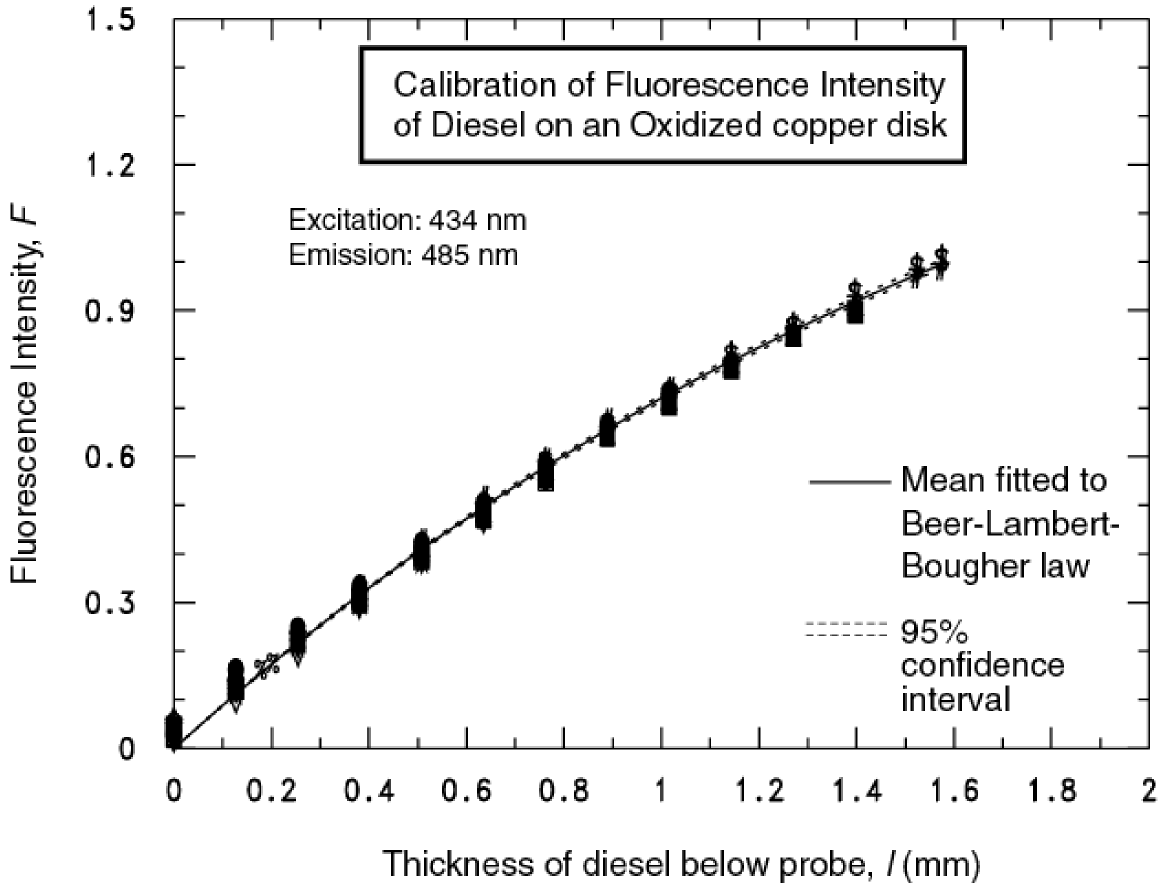

Fig. E.2 Calibration of fluorescence of diesel against path length for different runs

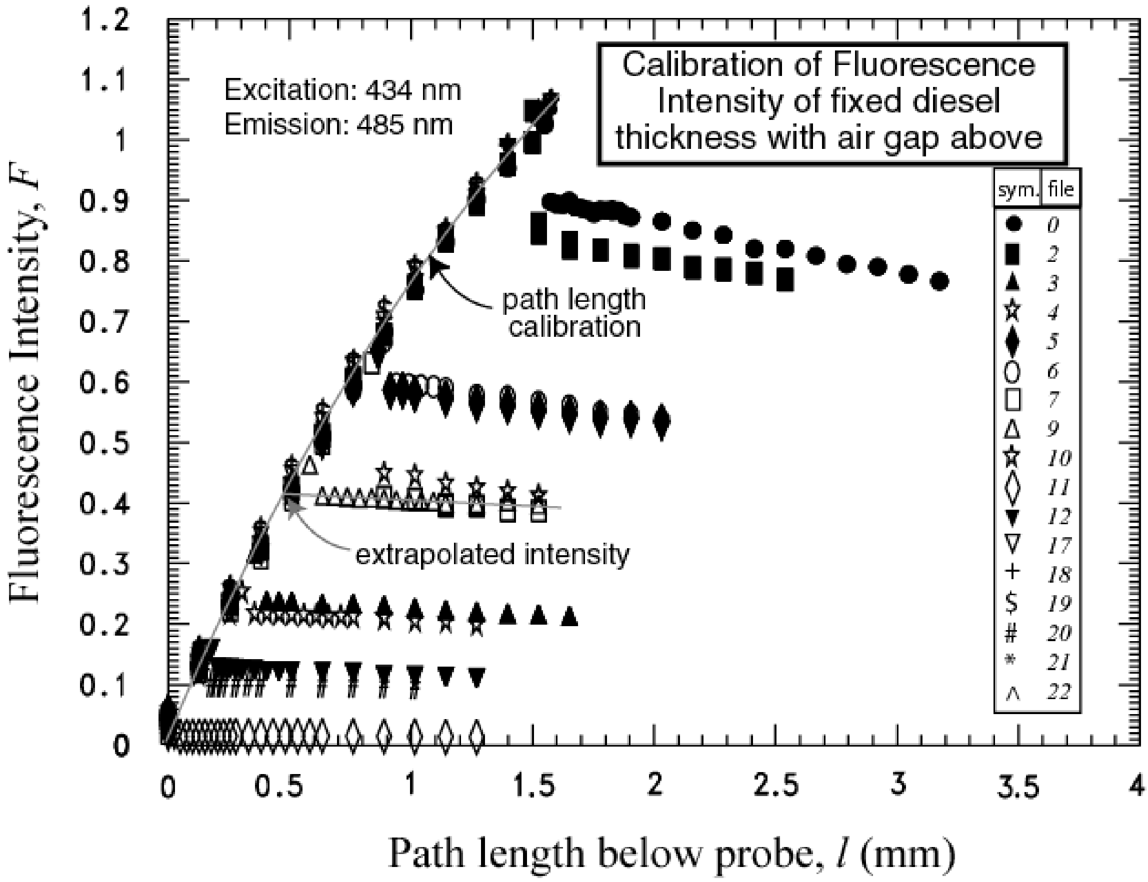

Fig. E.3 Calibration of diesel fluorescence intensity for fixed film thickness and air gap between quartz tube and liquid film

APPENDIX F: LINEAR BEER LAW

This appendix justifies the use of the linear form of the Beer-Lambert-Bougher law (Amadeo et al., 1971) for the fluorescence calibration of the diesel mass. Regression of the calibration varied mass fraction measurements to the exponential and complete form of the Beer-Lambert-Bougher law:

$$F = I_o \Phi (1 - 10^{-\varepsilon cl}) \qquad \text{(F.1)}$$

resulted in a residual standard deviation between the measurements and the fit of 0.0156. Considering that the residual standard deviation of the linear fit (eq. 3) was marginally less (0.0151) than that of eq. (F.1), the linear model represents the calibration data just as well as the complete model.

Further justification for the use of eq. (F.1) can be obtained from the general knowledge of fluorescence characteristics. According to Herman (1998), fluorescence remains directly proportional to absorbance (εcl) as long as it is small, i.e., $\varepsilon cl < 0.05$. Figure F.1 plots the absorbance against the mass fraction for both the mass fraction and the path length calibration measurements. The figure shows that mass fraction calibration measurements satisfy the linear criteria for mass fractions less than approximately 0.8. Similarly, the path length calibration measurements follow the linear Beer-Lambert-Bougher law for absorption thicknesses (l) less than approximately 1.3 mm. Overall, approximately 78 % of the 936 calibration measurements fall within the linear criteria and none of the measurements exceeded an absorbance of 0.064.

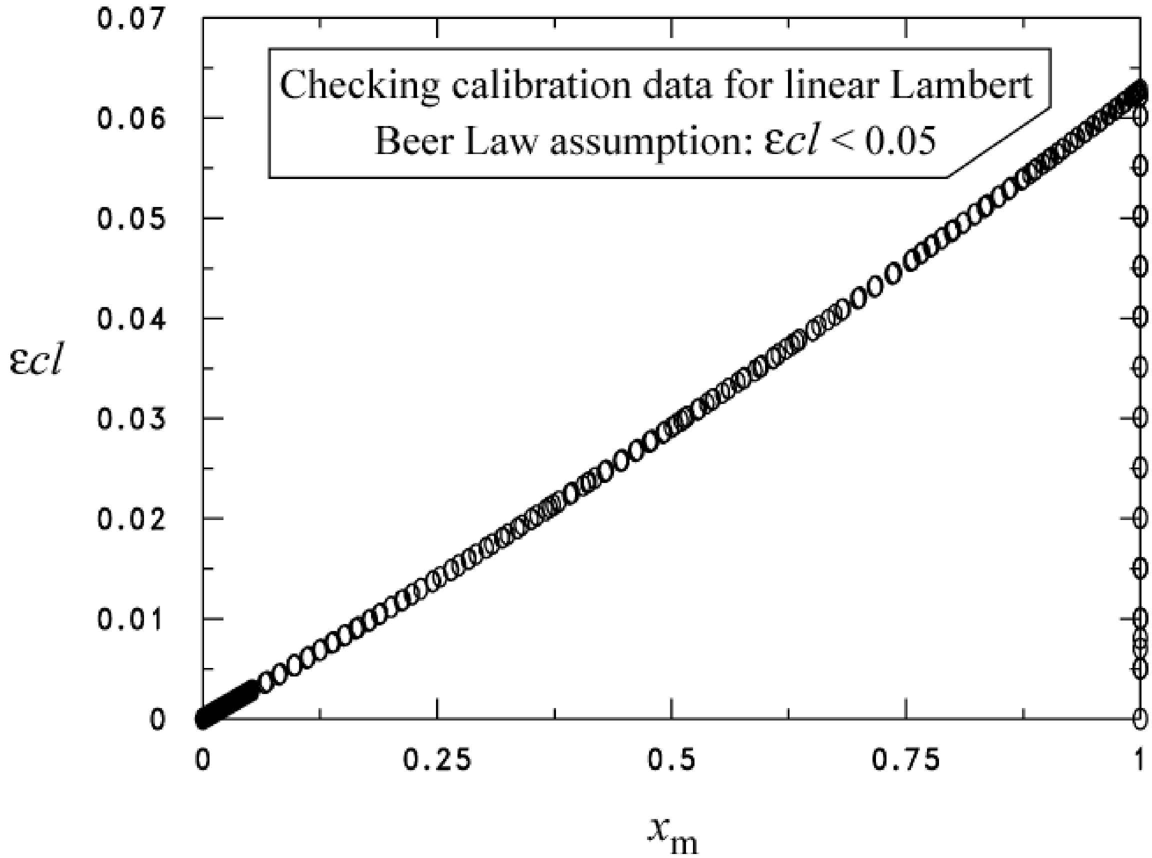

Fig. F.1 Absorbance of diesel for calibration measurements as a function of mass fraction

APPENDIX G: UNCERTAINTIES

Figure G.1 shows the relative (percent) uncertainty of the diesel excess layer thickness (U_{le}) as a function of l_e for a bulk mass fraction of nominally 0.2 %. Roughly 80 % of the l_e measurements for the 0.2 % bulk mass fraction have a relative uncertainty of less than 25 %. For measurements with an relative uncertainties less than 25 %, the average uncertainty of l_e is approximately ± 6 % of l_e. Overall, the average uncertainty of l_e on an absolute basis was approximately ± 0.1 μm.

Similarly, Fig. G.2 shows the relative (percent) uncertainty of the diesel excess layer thickness (U_{le}) as a function of l_e for a bulk mass fraction of nominally 0.3 %. Roughly 92 % of the l_e measurements have a relative uncertainty of less than 25 %. For these measurements the average uncertainty of l_e is approximately ± 8 % of l_e. Overall, the average uncertainty of l_e for the measurements with the 0.3 % bulk mass fraction was approximately ± 0.4 μm.

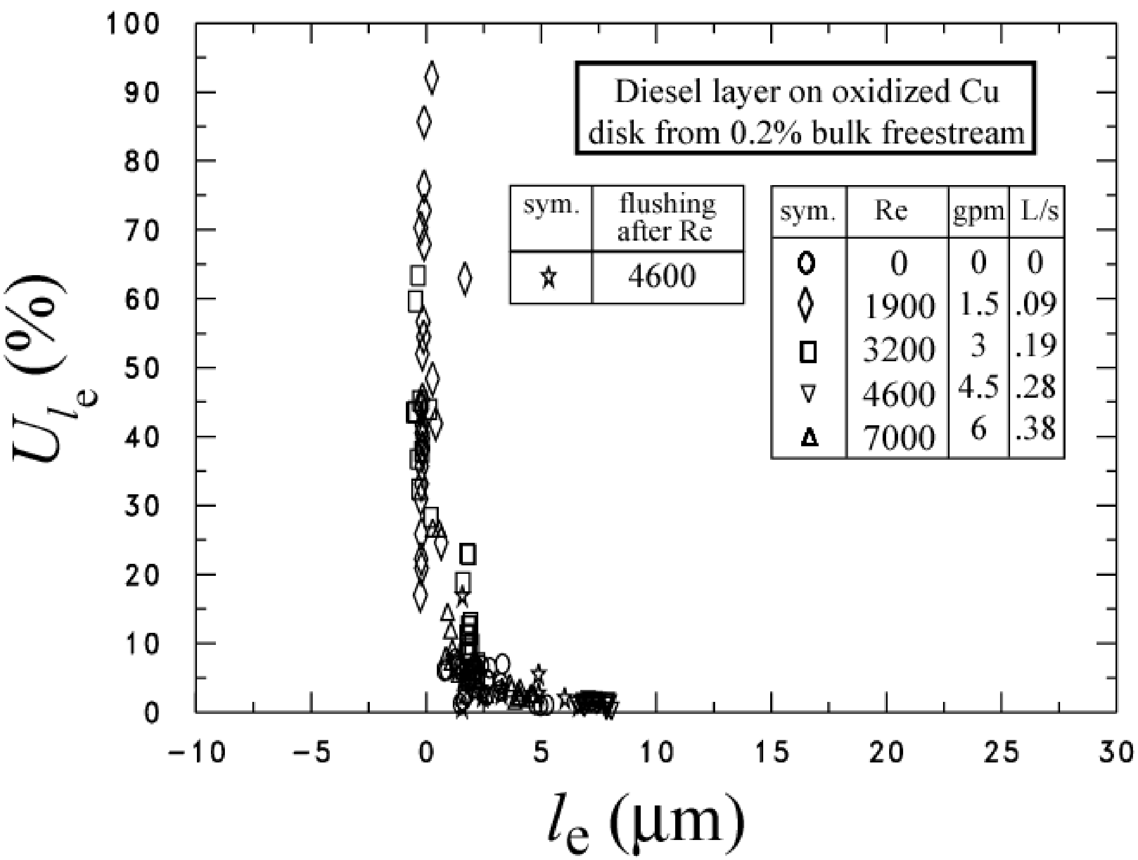

Fig. G.1 Relative uncertainty of l_e for 95 % confidence level and x_b = 0.2 %

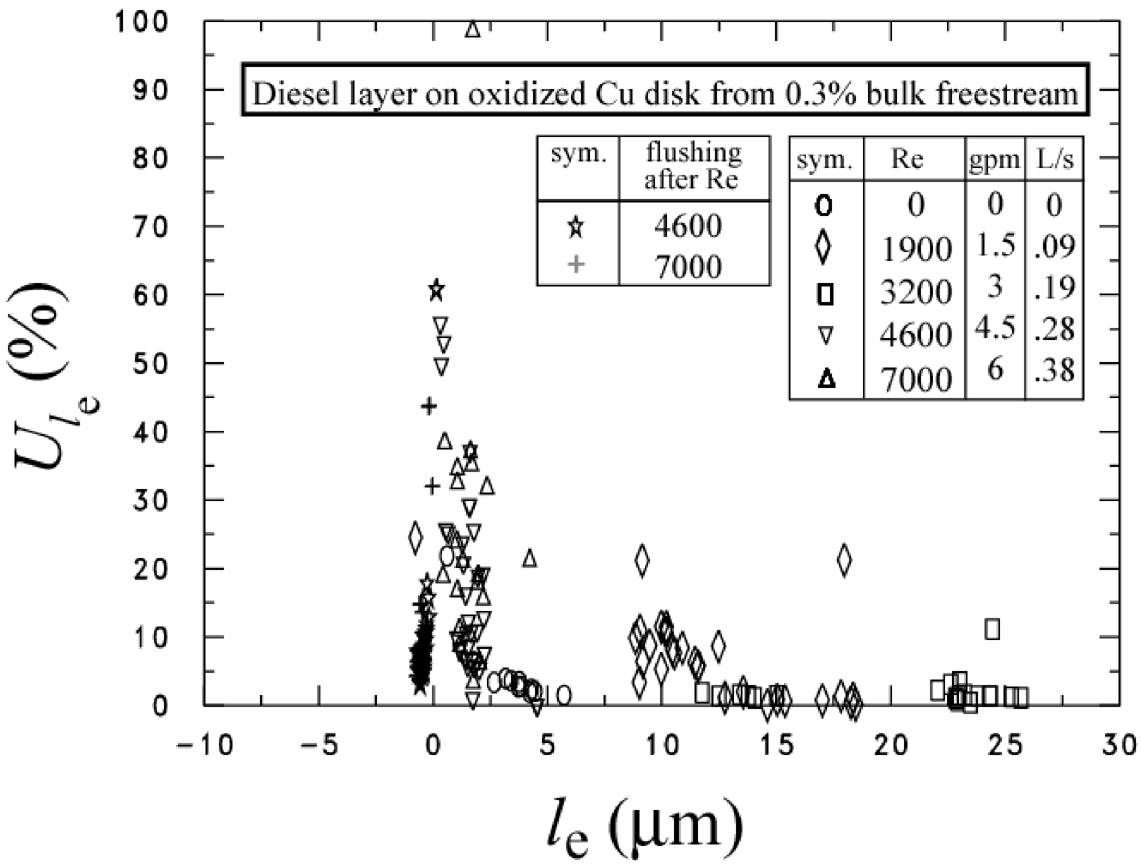

Fig. G.2 Relative uncertainty of l_e for 95 % confidence level and x_b = 0.3 %

APPENDIX H: TABULATED MEASUREMENTS

This appendix provides both raw and reduced tabulated traverse measurements. The raw measurements for the fluorescent intensities used in eq. (2), the salient measured temperatures, the varied path length (*l*), the exposure time and the water/diesel mixture flow rate are presented in Tables H.1. The data is presented sequentially as blocks of traverse measurements (traverse of typically 13 measurements of *l*, and intensity while maintaining the flow rate and temperatures) which typically required approximately 10 min to complete. Each block or group of measurements was used to obtain a single value for the diesel excess surface density following the procedure illustrated in Fig. 7.

Reduced measurements including the excess layer thickness following the procedure demonstrated in Fig. 7 are given in Tables H.2. In addition, the excess surface density as calculated from eq. (1), the diesel mass fraction as calculated from eq. (9), the average test section fluid temperature, and the effect of temperature on fluorescence as calculated from eq. (D.1) are provided. The exposure time is the real time measured from the time starting when the clean surface was first exposed to the particular flow rate.

All tables present only a fraction of the measures and are given to provide only an example. Complete data files are available upon request.

Table H.1.1 Diesel contamination on oxidized copper surface for Re = 0 and x_b = 0.2 %

Diesel contamination on oxidized copper surface for Re = 0 and x_b = 0.2 % (file: trv0con1.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.001242	0.001180	0.942909	0.000008	294.3	294.4	297.1	293.6	1.59	792.	0.0000	0.0625
0.001207	0.001147	0.942909	0.000008	294.3	294.5	296.7	293.6	1.52	842.	0.0000	0.0625
0.001249	0.001187	0.942909	0.000008	294.4	294.5	297.1	293.6	1.40	894.	0.0000	0.0625
0.001400	0.001330	0.942909	0.000008	294.4	294.6	297.1	293.6	1.27	945.	0.0000	0.0625
0.001449	0.001376	0.942909	0.000008	294.4	294.6	296.9	293.6	1.14	995.	0.0000	0.0625
0.001484	0.001409	0.942909	0.000008	294.5	294.7	297.2	293.6	1.02	1052.	0.0000	0.0625
0.001590	0.001510	0.942909	0.000008	294.5	294.7	296.9	293.6	0.89	1104.	0.0000	0.0625
0.001641	0.001558	0.942909	0.000008	294.5	294.7	296.9	293.6	0.76	1156.	0.0000	0.0625
0.001687	0.001602	0.942909	0.000008	294.6	294.8	297.0	293.6	0.64	1216.	0.0000	0.0697
0.001770	0.001679	0.942909	0.000008	294.6	294.8	296.8	293.6	0.51	1268.	0.0000	0.0738
0.001816	0.001724	0.942909	0.000008	294.6	294.9	297.1	293.6	0.38	1322.	0.0000	0.0697
0.001890	0.001794	0.942909	0.000008	294.6	294.9	297.0	293.6	0.25	1377.	0.0000	0.0800
0.001855	0.001760	0.942909	0.000008	294.7	294.9	296.9	293.6	0.13	1429.	0.0000	0.0853
0.002019	0.001910	0.935436	0.000017	294.8	295.1	297.1	293.6	1.59	1620.	0.0000	0.0625
0.001928	0.001825	0.935436	0.000017	294.8	295.1	297.0	293.6	1.52	1672.	0.0000	0.0624
0.002032	0.001922	0.935436	0.000017	294.8	295.1	297.3	293.6	1.40	1726.	0.0000	0.0625
0.002071	0.001959	0.935436	0.000017	294.8	295.1	297.0	293.6	1.27	1786.	0.0000	0.0625
0.002037	0.001927	0.935436	0.000017	294.8	295.1	297.1	293.6	1.14	1838.	0.0000	0.0624
0.002120	0.002005	0.935436	0.000017	294.9	295.2	297.0	293.6	1.02	1895.	0.0000	0.0625
0.002135	0.002019	0.935436	0.000017	294.9	295.2	297.1	293.6	0.89	1948.	0.0000	0.0625
0.002159	0.002042	0.935436	0.000017	294.9	295.2	297.3	293.6	0.76	2017.	0.0000	0.0739
0.002213	0.002093	0.935436	0.000017	294.9	295.2	297.0	293.6	0.64	2072.	0.0000	0.0781
0.002188	0.002069	0.935436	0.000017	294.9	295.3	297.2	293.6	0.51	2124.	0.0000	0.0745
0.002277	0.002152	0.935436	0.000017	295.0	295.3	297.2	293.6	0.38	2177.	0.0000	0.0625
0.002300	0.002175	0.935436	0.000017	295.0	295.3	297.1	293.6	0.25	2231.	0.0000	0.0625
0.002257	0.002134	0.935436	0.000017	295.0	295.3	297.0	293.6	0.13	2283.	0.0000	0.0709
0.001635	0.001631	0.985852	0.000013	295.5	296.0	297.2	293.6	1.59	6047.	0.0000	0.0625
0.001660	0.001655	0.985852	0.000013	295.5	296.0	296.9	293.6	1.52	6098.	0.0000	0.0624
0.001684	0.001679	0.985852	0.000013	295.5	296.0	297.0	293.6	1.40	6150.	0.0000	0.0625

Table H.1.2 Diesel contamination on oxidized copper surface for Re = 1900 and x_b = 0.2 %

Diesel contamination on oxidized copper surface for Re = 1900 and x_b = 0.2 % (file: trv15con1.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.003617	0.003772	1.010201	0.000107	295.5	295.5	297.6	293.6	1.59	1008.	0.0763	0.1093
0.003411	0.003563	1.010201	0.000107	295.5	295.4	297.7	293.6	1.52	1065.	0.0737	0.1058
0.003222	0.003372	1.010201	0.000107	295.4	295.4	297.5	293.6	1.40	1135.	0.0759	0.1042
0.003004	0.003151	1.010201	0.000107	295.4	295.4	297.4	293.6	1.27	1179.	0.0742	0.1106
0.002763	0.002906	1.010201	0.000107	295.4	295.4	297.8	293.6	1.14	1258.	0.0750	0.1004
0.002261	0.002398	1.010201	0.000107	295.4	295.4	297.6	293.6	1.02	1321.	0.0755	0.1085
0.002154	0.002289	1.010201	0.000107	295.3	295.3	297.4	293.6	0.89	1392.	0.0712	0.1106
0.001791	0.001921	1.010201	0.000107	295.3	295.3	297.6	293.6	0.76	1492.	0.0732	0.1222
0.001876	0.002007	1.010201	0.000107	295.3	295.3	297.5	293.6	0.64	1536.	0.0742	0.1033
0.001588	0.001716	1.010201	0.000107	295.2	295.3	297.6	293.6	0.51	1574.	0.0745	0.1069
0.001351	0.001475	1.010201	0.000107	295.2	295.2	297.5	293.6	0.38	1617.	0.0710	0.1023
0.000918	0.001038	1.010201	0.000107	295.2	295.2	297.5	293.6	0.25	1661.	0.0720	0.1124
0.000574	0.000688	1.010201	0.000107	295.2	295.2	297.6	293.6	0.13	1705.	0.0747	0.1087
0.002523	0.002562	1.008425	0.000018	293.5	293.5	297.6	293.6	1.59	61523.	0.0844	0.1042
0.002449	0.002488	1.008425	0.000018	293.5	293.5	297.2	293.6	1.52	61568.	0.0874	0.1111
0.002293	0.002330	1.008425	0.000018	293.5	293.5	297.6	293.6	1.40	61614.	0.0864	0.1151
0.002095	0.002131	1.008425	0.000018	293.4	293.4	297.5	293.6	1.27	61656.	0.0869	0.1167
0.001901	0.001935	1.008425	0.000018	293.4	293.4	297.6	293.6	1.14	61697.	0.0870	0.1146
0.001768	0.001801	1.008425	0.000018	293.4	293.4	297.3	293.6	1.02	61743.	0.0877	0.1175
0.001607	0.001638	1.008425	0.000018	293.4	293.4	297.3	293.6	0.89	61782.	0.0833	0.1163
0.001453	0.001483	1.008425	0.000018	293.4	293.4	297.4	293.6	0.76	61823.	0.0866	0.1192
0.001238	0.001266	1.008425	0.000018	293.4	293.4	297.2	293.6	0.64	61865.	0.0853	0.1168
0.001073	0.001100	1.008425	0.000018	293.3	293.4	297.1	293.6	0.51	61905.	0.0827	0.1161
0.000963	0.000989	1.008425	0.000018	293.3	293.3	297.4	293.6	0.38	61946.	0.0866	0.1187
0.000763	0.000788	1.008425	0.000018	293.3	293.3	297.1	293.6	0.25	61987.	0.0858	0.1168
0.000609	0.000632	1.008425	0.000018	293.3	293.3	297.3	293.6	0.13	62026.	0.0875	0.1157
0.002626	0.002759	1.007386	0.000116	293.3	293.3	297.5	293.6	1.59	62198.	0.0833	0.1161
0.002493	0.002625	1.007386	0.000116	293.3	293.3	297.7	293.6	1.52	62241.	0.0848	0.1130
0.002345	0.002476	1.007386	0.000116	293.2	293.2	297.5	293.6	1.40	62282.	0.0870	0.1108
0.002184	0.002314	1.007386	0.000116	293.2	293.2	297.3	293.6	1.27	62324.	0.0853	0.1185
0.002013	0.002142	1.007386	0.000116	293.2	293.2	297.2	293.6	1.14	62367.	0.0833	0.1127
0.001872	0.002001	1.007386	0.000116	293.2	293.2	296.9	293.6	1.02	62409.	0.0872	0.1105
0.001720	0.001847	1.007386	0.000116	293.2	293.2	297.0	293.6	0.89	62454.	0.0852	0.1062
0.001540	0.001666	1.007386	0.000116	293.2	293.2	297.3	293.6	0.76	62498.	0.0858	0.1119
0.001507	0.001633	1.007386	0.000116	293.2	293.2	297.3	293.6	0.64	62539.	0.0829	0.1194
0.001393	0.001518	1.007386	0.000116	293.2	293.2	297.1	293.6	0.51	62581.	0.0862	0.1241
0.001258	0.001382	1.007386	0.000116	293.2	293.2	297.2	293.6	0.38	62622.	0.0863	0.1229
0.001078	0.001201	1.007386	0.000116	293.2	293.2	297.1	293.6	0.25	62664.	0.0868	0.1238
0.000830	0.000951	1.007386	0.000116	293.2	293.2	297.2	293.6	0.13	62707.	0.0843	0.1239
0.002796	0.002894	1.012094	0.000064	293.7	293.7	297.5	293.6	1.59	66387.	0.0870	0.1184
0.002666	0.002762	1.012094	0.000064	293.7	293.7	297.6	293.6	1.52	66427.	0.0862	0.1222
0.002592	0.002687	1.012094	0.000064	293.6	293.6	297.5	293.6	1.40	66469.	0.0845	0.1167
0.002529	0.002624	1.012094	0.000064	293.6	293.6	297.6	293.6	1.27	66509.	0.0883	0.1163
0.003842	0.003952	1.012094	0.000064	293.6	293.6	297.4	293.6	1.14	66551.	0.0877	0.1179
0.003831	0.003941	1.012094	0.000064	293.6	293.6	297.2	293.6	1.02	66592.	0.0877	0.1143
0.003148	0.003250	1.012094	0.000064	293.5	293.6	297.4	293.6	0.89	66632.	0.0865	0.1092
0.002608	0.002703	1.012094	0.000064	293.5	293.5	297.4	293.6	0.76	66709.	0.0816	0.1067
0.002231	0.002321	1.012094	0.000064	293.5	293.5	297.5	293.6	0.64	66749.	0.0836	0.1163
0.001971	0.002059	1.012094	0.000064	293.4	293.5	297.7	293.6	0.51	66788.	0.0864	0.1092
0.001619	0.001702	1.012094	0.000064	293.4	293.4	297.5	293.6	0.38	66829.	0.0829	0.1110
0.001524	0.001606	1.012094	0.000064	293.4	293.4	297.2	293.6	0.25	66869.	0.0872	0.1138
0.001461	0.001542	1.012094	0.000064	293.4	293.4	297.1	293.6	0.13	66910.	0.0850	0.1169
0.003188	0.003266	1.009252	0.000047	294.0	293.9	296.5	293.6	1.59	69847.	0.0853	0.1064
0.003181	0.003259	1.009252	0.000047	294.0	293.9	296.3	293.6	1.52	69884.	0.0834	0.1082
0.003045	0.003122	1.009252	0.000047	294.0	293.9	296.5	293.6	1.40	69926.	0.0857	0.1098
0.002962	0.003038	1.009252	0.000047	294.0	294.0	296.5	293.6	1.27	69967.	0.0859	0.1106
0.002824	0.002898	1.009252	0.000047	294.0	294.0	296.3	293.6	1.14	70009.	0.0862	0.1147

Table H.1.3 Diesel contamination on oxidized copper surface for Re = 3200 and x_b = 0.2 %

Diesel contamination on oxidized copper surface for Re = 3200 and x_b = 0.2 % (file: trv3con1.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.003391	0.003385	1.002145	-0.0000260	296.2	296.1	296.1	293.6	1.59	1521.	0.1558	0.1596
0.003188	0.003182	1.002145	-0.000026	296.2	296.1	296.0	293.6	1.52	1563.	0.1512	0.1566
0.003292	0.003286	1.002145	-0.000026	296.2	296.1	296.0	293.6	1.40	1607.	0.1550	0.1613
0.003003	0.002996	1.002145	-0.000026	296.2	296.2	296.0	293.6	1.27	1706.	0.1531	0.1577
0.002738	0.002728	1.002145	-0.000026	296.2	296.2	295.9	293.6	1.14	1749.	0.1509	0.1601
0.002347	0.002335	1.002145	-0.000026	296.2	296.2	295.7	293.6	1.02	1789.	0.1476	0.1620
0.001922	0.001908	1.002145	-0.000026	296.2	296.2	295.3	293.6	0.89	1831.	0.1550	0.1634
0.001679	0.001663	1.002145	-0.000026	296.2	296.2	296.5	293.6	0.76	1873.	0.1453	0.1589
0.001387	0.001369	1.002145	-0.000026	296.2	296.2	296.2	293.6	0.64	1920.	0.1557	0.1587
0.001198	0.001179	1.002145	-0.000026	296.2	296.2	295.6	293.6	0.51	1966.	0.1535	0.1517
0.000929	0.000908	1.002145	-0.000026	296.2	296.2	295.8	293.6	0.38	2009.	0.1550	0.1509
0.000584	0.000561	1.002145	-0.000026	296.2	296.2	296.1	293.6	0.25	2051.	0.1542	0.1502
0.000082	0.000056	1.002145	-0.000026	296.2	296.2	296.0	293.6	0.13	2092.	0.1501	0.1581
0.003134	0.003115	1.006735	-0.000052	296.2	296.2	295.3	293.6	1.59	2224.	0.1470	0.1501
0.002885	0.002864	1.006735	-0.000052	296.2	296.2	295.2	293.6	1.52	2267.	0.1509	0.1669
0.002841	0.002819	1.006735	-0.000052	296.2	296.1	295.4	293.7	1.40	2310.	0.1550	0.1654
0.002923	0.002902	1.006735	-0.000052	296.2	296.1	295.9	293.6	1.27	2354.	0.1535	0.1563
0.002583	0.002558	1.006735	-0.000052	296.1	296.1	295.5	293.6	1.14	2401.	0.1480	0.1649
0.002263	0.002235	1.006735	-0.000052	296.1	296.1	296.0	293.6	1.02	2442.	0.1498	0.1600
0.001828	0.001795	1.006735	-0.000052	296.1	296.1	295.8	293.6	0.89	2482.	0.1546	0.1587
0.001410	0.001373	1.006735	-0.000052	296.1	296.1	295.4	293.6	0.76	2524.	0.1523	0.1517
0.001121	0.001081	1.006735	-0.000052	296.1	296.1	296.1	293.6	0.64	2569.	0.1516	0.1553
0.000973	0.000931	1.006735	-0.000052	296.1	296.0	295.6	293.6	0.51	2775.	0.1487	0.1572
0.000673	0.000628	1.006735	-0.000052	296.0	296.0	295.7	293.6	0.38	2819.	0.1487	0.1486
0.000397	0.000349	1.006735	-0.000052	296.0	296.0	295.8	293.6	0.25	2862.	0.1531	0.1543
0.000080	0.000029	1.006735	-0.000052	296.0	296.0	295.8	293.6	0.13	2903.	0.1466	0.1421
0.002741	0.002780	1.007206	0.000016	294.4	294.4	296.2	293.6	1.59	5441.	0.1543	0.1350
0.002670	0.002709	1.007206	0.000016	294.4	294.4	296.6	293.6	1.52	5486.	0.1535	0.1459
0.002594	0.002632	1.007206	0.000016	294.4	294.3	296.6	293.6	1.40	5531.	0.1550	0.1662
0.002476	0.002512	1.007206	0.000016	294.3	294.3	296.6	293.6	1.27	5572.	0.1562	0.1562
0.002236	0.002270	1.007206	0.000016	294.3	294.3	296.5	293.6	1.14	5619.	0.1509	0.1455
0.001912	0.001944	1.007206	0.000016	294.3	294.3	296.8	293.6	1.02	5660.	0.1532	0.1485
0.001566	0.001595	1.007206	0.000016	294.2	294.2	296.9	293.6	0.89	5702.	0.1488	0.1517
0.001214	0.001240	1.007206	0.000016	294.2	294.2	296.4	293.6	0.76	5744.	0.1528	0.1430
0.000993	0.001017	1.007206	0.000016	294.2	294.2	296.4	293.6	0.64	5783.	0.1488	0.1453
0.000791	0.000813	1.007206	0.000016	294.1	294.1	296.0	293.6	0.51	5824.	0.1477	0.1454
0.000601	0.000622	1.007206	0.000016	294.1	294.1	296.5	293.6	0.38	5866.	0.1554	0.1476
0.000331	0.000350	1.007206	0.000016	294.1	294.1	295.8	293.6	0.25	5909.	0.1539	0.1425
0.000083	0.000100	1.007206	0.000016	294.0	294.0	295.7	293.6	0.13	5957.	0.1481	0.1432
0.002855	0.002877	0.999473	0.000026	293.2	293.2	296.4	293.7	1.59	8736.	0.1562	0.1391
0.002723	0.002746	0.999473	0.000026	293.2	293.2	296.1	293.7	1.52	8776.	0.1562	0.1290
0.002447	0.002470	0.999473	0.000026	293.2	293.2	296.3	293.6	1.40	8821.	0.1570	0.1397
0.002283	0.002307	0.999473	0.000026	293.3	293.2	296.1	293.6	1.27	8865.	0.1524	0.1531
0.002136	0.002160	0.999473	0.000026	293.3	293.3	295.9	293.7	1.14	8906.	0.1502	0.1457
0.001921	0.001946	0.999473	0.000026	293.3	293.3	295.9	293.6	1.02	8946.	0.1547	0.1348
0.001659	0.001683	0.999473	0.000026	293.3	293.3	296.0	293.6	0.89	8988.	0.1513	0.1328
0.001420	0.001445	0.999473	0.000026	293.3	293.3	296.7	293.6	0.76	9028.	0.1521	0.1226
0.001140	0.001165	0.999473	0.000026	293.3	293.3	296.6	293.7	0.64	9070.	0.1528	0.1392
0.000918	0.000943	0.999473	0.000026	293.4	293.3	296.3	293.6	0.51	9116.	0.1578	0.1413
0.000610	0.000636	0.999473	0.000026	293.4	293.3	296.2	293.6	0.38	9162.	0.1547	0.1497
0.000373	0.000399	0.999473	0.000026	293.4	293.4	296.1	293.6	0.25	9204.	0.1502	0.1482
0.000174	0.000200	0.999473	0.000026	293.4	293.4	296.0	293.6	0.13	9244.	0.1506	0.1494
0.002669	0.002642	0.986360	0.000010	293.5	293.5	296.1	293.7	1.59	9383.	0.1559	0.1608
0.002560	0.002534	0.986360	0.000010	293.5	293.5	296.7	293.7	1.52	9424.	0.1510	0.1470
0.002486	0.002462	0.986360	0.000010	293.5	293.5	296.8	293.6	1.40	9465.	0.1543	0.1328
0.002299	0.002278	0.986360	0.000010	293.5	293.5	296.8	293.6	1.27	9506.	0.1543	0.1232
0.002114	0.002095	0.986360	0.000010	293.6	293.5	296.9	293.6	1.14	9548.	0.1562	0.1415
0.001922	0.001905	0.986360	0.000010	293.6	293.6	296.5	293.6	1.02	9592.	0.1558	0.1516

Table H.1.4 Diesel contamination on oxidized copper surface for Re = 4600 and x_b = 0.2 %

Diesel contamination on oxidized copper surface for Re = 4600 and x_b = 0.2 % (file: trv45con1.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.0071260	0.007198	1.006097	0.000032	293.4	293.4	294.7	293.6	1.59	236041.	0.2280	0.2502
0.007096	0.007168	1.006097	0.000032	293.4	293.4	294.5	293.6	1.52	236081.	0.2305	0.2517
0.007047	0.007119	1.006097	0.000032	293.4	293.4	294.6	293.6	1.40	236122.	0.2191	0.2518
0.007094	0.007166	1.006097	0.000032	293.4	293.4	294.7	293.6	1.27	236166.	0.2280	0.2526
0.007073	0.007145	1.006097	0.000032	293.4	293.4	294.6	293.6	1.14	236207.	0.2264	0.2534
0.007054	0.007126	1.006097	0.000032	293.4	293.4	294.7	293.6	1.02	236249.	0.2238	0.2539
0.007076	0.007148	1.006097	0.000032	293.4	293.4	294.7	293.6	0.89	236293.	0.2255	0.2511
0.007170	0.007242	1.006097	0.000032	293.4	293.4	294.7	293.6	0.76	236338.	0.2169	0.2425
0.007069	0.007141	1.006097	0.000032	293.4	293.4	295.0	293.6	0.64	236382.	0.2264	0.2245
0.007079	0.007151	1.006097	0.000032	293.4	293.4	294.9	293.6	0.51	236423.	0.2199	0.2101
0.007225	0.007299	1.006097	0.000032	293.4	293.4	294.9	293.6	0.38	236464.	0.2222	0.1988
0.007117	0.007190	1.006097	0.000032	293.4	293.4	294.6	293.6	0.25	236505.	0.2176	0.1980
0.007247	0.007321	1.006097	0.000032	293.5	293.4	294.6	293.6	0.13	236554.	0.2246	0.1958
0.007107	0.007254	1.010847	0.000072	293.5	293.5	294.7	293.6	1.59	236711.	0.2215	0.2049
0.007058	0.007205	1.010847	0.000072	293.6	293.5	294.5	293.6	1.52	236754.	0.2246	0.2016
0.006926	0.007071	1.010847	0.000072	293.6	293.5	294.4	293.6	1.40	236797.	0.2215	0.2097
0.006983	0.007130	1.010847	0.000072	293.6	293.6	294.6	293.6	1.27	236838.	0.2215	0.2197
0.007073	0.007221	1.010847	0.000072	293.6	293.6	294.7	293.6	1.14	236883.	0.2223	0.2426
0.006951	0.007097	1.010847	0.000072	293.6	293.6	294.0	293.6	1.02	236931.	0.2184	0.2300
0.007007	0.007155	1.010847	0.000072	293.6	293.6	294.4	293.6	0.89	236982.	0.2176	0.2184
0.007060	0.007208	1.010847	0.000072	293.7	293.6	294.6	293.6	0.76	237026.	0.2146	0.2313
0.006998	0.007146	1.010847	0.000072	293.7	293.7	294.7	293.6	0.64	237070.	0.2288	0.2428
0.007111	0.007260	1.010847	0.000072	293.7	293.7	294.8	293.6	0.51	237111.	0.2161	0.2415
0.007065	0.007214	1.010847	0.000072	293.8	293.7	294.7	293.6	0.38	237152.	0.2154	0.2009
0.007105	0.007255	1.010847	0.000072	293.8	293.8	294.6	293.6	0.25	237198.	0.2231	0.2004
0.007172	0.007323	1.010847	0.000072	293.8	293.8	294.6	293.6	0.13	237241.	0.2314	0.1928
0.006849	0.007022	1.014358	0.000078	293.4	293.4	294.6	293.7	1.59	240174.	0.2232	0.2063
0.006815	0.006988	1.014358	0.000078	293.4	293.4	294.8	293.6	1.52	240224.	0.2185	0.2267
0.006847	0.007020	1.014358	0.000078	293.4	293.4	294.6	293.6	1.40	240267.	0.2184	0.2373
0.006850	0.007023	1.014358	0.000078	293.4	293.4	294.6	293.6	1.27	240313.	0.2200	0.2540
0.006814	0.006986	1.014358	0.000078	293.4	293.4	294.6	293.6	1.14	240355.	0.2192	0.2564
0.006853	0.007025	1.014358	0.000078	293.4	293.4	294.6	293.6	1.02	240396.	0.2185	0.2566
0.006883	0.007056	1.014358	0.000078	293.4	293.4	294.8	293.6	0.89	240460.	0.2263	0.2379
0.006854	0.007027	1.014358	0.000078	293.4	293.4	294.9	293.6	0.76	240502.	0.2264	0.2355
0.006924	0.007098	1.014358	0.000078	293.4	293.4	294.9	293.6	0.64	240546.	0.2192	0.2505
0.006944	0.007118	1.014358	0.000078	293.4	293.4	295.1	293.6	0.51	240591.	0.2255	0.2512
0.007005	0.007180	1.014358	0.000078	293.4	293.4	294.9	293.6	0.38	240635.	0.2169	0.2541
0.007047	0.007223	1.014358	0.000078	293.4	293.4	294.8	293.6	0.25	240679.	0.2232	0.2533
0.007078	0.007254	1.014358	0.000078	293.4	293.4	294.8	293.6	0.13	240723.	0.2154	0.2519
0.006790	0.006826	1.005077	-0.000003	294.1	294.0	295.3	293.6	1.59	243116.	0.2231	0.2427
0.006778	0.006814	1.005077	-0.000003	294.0	294.0	295.5	293.6	1.52	243163.	0.2296	0.2392
0.006690	0.006725	1.005077	-0.000003	294.0	294.0	295.7	293.6	1.40	243213.	0.2255	0.2352
0.006790	0.006825	1.005077	-0.000003	294.0	294.0	295.4	293.6	1.27	243257.	0.2215	0.2321
0.006798	0.006833	1.005077	-0.000003	294.0	294.0	295.1	293.6	1.14	243301.	0.2131	0.2323
0.006825	0.006860	1.005077	-0.000003	294.0	293.9	295.1	293.6	1.02	243345.	0.2231	0.2397
0.006816	0.006851	1.005077	-0.000003	294.0	293.9	295.0	293.6	0.89	243390.	0.2138	0.2493
0.006828	0.006863	1.005077	-0.000003	293.9	293.9	295.4	293.6	0.76	243433.	0.2296	0.2424
0.006875	0.006910	1.005077	-0.000003	293.9	293.9	295.3	293.6	0.64	243474.	0.2263	0.2402
0.006892	0.006927	1.005077	-0.000003	293.9	293.9	295.1	293.6	0.51	243515.	0.2255	0.2316
0.006982	0.007017	1.005077	-0.000003	293.9	293.9	295.0	293.6	0.38	243556.	0.2223	0.2139
0.006975	0.007010	1.005077	-0.000003	293.9	293.9	294.8	293.6	0.25	243596.	0.2177	0.2067
0.006999	0.007034	1.005077	-0.000003	293.9	293.9	294.8	293.6	0.13	243639.	0.2239	0.2073
0.006855	0.006929	1.005073	0.000038	293.8	293.8	295.2	293.6	1.59	243799.	0.2247	0.1886
0.006817	0.006890	1.005073	0.000038	293.8	293.8	295.1	293.6	1.52	243844.	0.2223	0.1999
0.006834	0.006907	1.005073	0.000038	293.8	293.8	295.0	293.6	1.40	243886.	0.2247	0.2027
0.006828	0.006901	1.005073	0.000038	293.8	293.7	294.9	293.6	1.27	243929.	0.2200	0.2222
0.006852	0.006925	1.005073	0.000038	293.7	293.7	294.9	293.6	1.14	243972.	0.2247	0.2475

Table H.1.5 Diesel contamination on oxidized copper surface for Re = 7000 and x_b = 0.2 %

Diesel contamination on oxidized copper surface for Re = 7000 and x_b = 0.2 % (file:trv6con1.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.002504	0.002483	1.005823	-0.00005	297.5	297.4	296.8	293.7	1.59	4639.	0.3299	0.3423
0.002400	0.002378	1.005823	-0.000050	297.5	297.5	296.6	293.7	1.52	4684.	0.3265	0.3417
0. 02268	0.002245	1.005823	-0.000050	297.6	297.5	297.0	293.7	1.40	4728.	0.3215	0.3391
0.002026	0.002000	1.005823	-0.000050	297.6	297.6	297.1	293.7	1.27	4771.	0.3167	0.3415
0.001853	0.001825	1.005823	-0.000050	297.6	297.6	296.9	293.7	1.14	4813.	0.3300	0.3453
0.001738	0.001709	1.005823	-0.000050	297.7	297.6	296.9	293.7	1.02	4857.	0.3181	0.3406
0.001519	0.001487	1.005823	-0.000050	297.7	297.7	296.8	293.7	0.89	4900.	0.3333	0.3420
0.001320	0.001285	1.005823	-0.000050	297.7	297.7	296.8	293.7	0.76	4943.	0.3214	0.3377
0.001150	0.001114	1.005823	-0.000050	297.8	297.7	296.9	293.6	0.64	4987.	0.3249	0.3425
0.000987	0.000949	1.005823	-0.000050	297.8	297.8	297.0	293.6	0.51	5029.	0.3282	0.3401
0.000803	0.000762	1.005823	-0.000050	297.8	297.8	297.1	293.7	0.38	5075.	0.3214	0.3392
0.000611	0.000568	1.005823	-0.000050	297.8	297.8	296.9	293.7	0.25	5122.	0.3133	0.3435
0.000479	0.000434	1.005823	-0.000050	297.9	297.8	297.1	293.7	0.13	5163.	0.3352	0.3391
0.002624	0.002647	1.006991	-0.000013	297.9	297.9	296.8	293.7	1.59	5325.	0.3232	0.3398
0.002535	0.002557	1.006991	-0.000013	297.9	297.9	297.0	293.7	1.52	5366.	0.3182	0.3404
0.002339	0.002358	1.006991	-0.000013	298.0	297.9	296.9	293.7	1.40	5412.	0.3181	0.3514
0.002156	0.002172	1.006991	-0.000013	298.0	297.9	297.0	293.7	1.27	5459.	0.3197	0.3590
0.001968	0.001982	1.006991	-0.000013	298.0	297.9	297.2	293.7	1.14	5511.	0.3231	0.3589
0.001751	0.001762	1.006991	-0.000013	298.0	297.9	297.0	293.7	1.02	5554.	0.3299	0.3511
0.001554	0.001562	1.006991	-0.000013	298.0	298.0	297.0	293.7	0.89	5600.	0.3317	0.3442
0.001390	0.001396	1.006991	-0.000013	298.0	298.0	296.8	293.7	0.76	5642.	0.3282	0.3571
0.001155	0.001158	1.006991	-0.000013	298.0	298.0	296.9	293.7	0.64	5685.	0.3165	0.3454
0.000955	0.000955	1.006991	-0.000013	298.0	298.0	297.0	293.7	0.51	5726.	0.3317	0.3504
0.000762	0.000759	1.006991	-0.000013	298.0	298.0	297.0	293.7	0.38	5771.	0.3299	0.3401
0.000603	0.000598	1.006991	-0.000013	298.0	298.0	296.9	293.7	0.25	5818.	0.3317	0.3394
.000443	0.000436	1.006991	-0.000013	298.0	298.0	297.0	293.7	0.13	5865.	0.3214	0.3467
.002757	0.002840	1.004241	0.000055	297.4	297.3	297.3	293.7	1.59	7893.	0.3316	0.3527
.002633	0.002714	1.004241	0.000055	297.3	297.3	297.5	293.7	1.52	7942.	0.3408	0.3492
.002596	0.002676	1.004241	0.000055	297.3	297.3	297.7	293.7	1.40	7988.	0.3249	0.3486
.002495	0.002574	1.004241	0.000055	297.3	297.3	297.4	293.7	1.27	8031.	0.3335	0.3486
.002276	0.002354	1.004241	0.000055	297.3	297.3	297.4	293.7	1.14	8072.	0.3370	0.3499
.002094	0.002169	1.004241	0.000055	297.2	297.2	297.3	293.7	1.02	8115.	0.3166	0.3528
.001767	0.001840	1.004241	0.000055	297.2	297.2	297.6	293.7	0.89	8159.	0.3282	0.3562
.001538	0.001608	1.004241	0.000055	297.2	297.2	297.5	293.7	0.76	8202.	0.3197	0.3500
.001401	0.001469	1.004241	0.000055	297.2	297.2	297.4	293.7	0.64	8245.	0.3264	0.3524
.001210	0.001276	1.004241	0.000055	297.2	297.1	297.5	293.7	0.51	8296.	0.3335	0.3529
.001021	0.001086	1.004241	0.000055	297.1	297.1	297.4	293.7	0.38	8341.	0.3266	0.3500
.000822	0.000884	1.004241	0.000055	297.1	297.1	297.5	293.7	0.25	8392.	0.3248	0.3483
.000718	0.000780	1.004241	0.000055	297.1	297.1	297.6	293.7	0.13	8449.	0.3335	0.3437
.003012	0.003122	1.010220	0.000071	295.4	295.4	297.5	293.7	1.59	11766.	0.3337	0.3416
.002916	0.003025	1.010220	0.000071	295.4	295.4	297.5	293.7	1.52	11806.	0.3319	0.3414
.002828	0.002936	1.010220	0.000071	295.4	295.4	297.6	293.7	1.40	11848.	0.3372	0.3358
.002715	0.002821	1.010220	0.000071	295.4	295.4	297.4	293.7	1.27	11894.	0.3372	0.3367
.002608	0.002713	1.010220	0.000071	295.3	295.3	297.5	293.7	1.14	11937.	0.3184	0.3550
.002429	0.002531	1.010220	0.000071	295.3	295.3	297.6	293.7	1.02	11984.	0.3266	0.3483
.002213	0.002313	1.010220	0.000071	295.3	295.3	297.6	293.7	0.89	12032.	0.3250	0.3441
.002003	0.002100	1.010220	0.000071	295.3	295.3	297.5	293.7	0.76	12082.	0.3354	0.3192
.001850	0.001945	1.010220	0.000071	295.3	295.3	297.4	293.7	0.64	12124.	0.3374	0.3216
.001622	0.001714	1.010220	0.000071	295.2	295.2	297.5	293.7	0.51	12168.	0.3337	0.3134
.001473	0.001564	1.010220	0.000071	295.2	295.2	297.7	293.7	0.38	12208.	0.3216	0.3164
.001245	0.001333	1.010220	0.000071	295.2	295.2	297.4	293.7	0.25	12252.	0.3284	0.3298
.001071	0.001156	1.010220	0.000071	295.2	295.2	297.6	293.7	0.13	12298.	0.3284	0.3386
.003126	0.003182	1.005162	0.000033	295.1	295.1	297.4	293.7	1.59	12461.	0.3266	0.3588
.003037	0.003092	1.005162	0.000033	295.1	295.1	297.4	293.7	1.52	12506.	0.3216	0.3555
.002849	0.002903	1.005162	0.000033	295.1	295.1	297.5	293.7	1.40	12550.	0.3354	0.3592
.002710	0.002763	1.005162	0.000033	295.0	295.0	297.3	293.7	1.27	12595.	0.3185	0.3491
.002642	0.002694	1.005162	0.000033	295.0	295.0	297.6	293.7	1.14	12637.	0.3267	0.3426

Table H.1.6 Tap water flushing after Re = 4600 contamination tests at x_b = 0.2 %

Tap water flushing after Re = 4600 contamination tests at x_b = 0.2 % (file:flsh45c1.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.004939	0.004940	0.996651	-.000033	300.0	300.1	295.2	293.6	1.59	2413.	N/A	N/A
0.004815	0.004814	0.996651	-.000033	299.9	300.0	295.5	293.6	1.52	2467.	N/A	N/A
0.004740	0.004738	0.996651	-.000033	299.9	299.9	295.3	293.6	1.40	2522.	N/A	N/A
0.004705	0.004703	0.996651	-.000033	299.9	299.9	295.6	293.6	1.27	2574.	N/A	N/A
0.004696	0.004693	0.996651	-.000033	299.8	299.8	295.6	293.6	1.14	2634.	N/A	N/A
0.004677	0.004674	0.996651	-.000033	299.8	299.8	295.5	293.6	1.02	2686.	N/A	N/A
0.004686	0.004683	0.996651	-.000033	299.7	299.7	295.4	293.6	0.89	2744.	N/A	N/A
0.004756	0.004753	0.996651	-.000033	299.7	299.6	295.6	293.6	0.76	2796.	N/A	N/A
0.004820	0.004817	0.996651	-.000033	299.6	299.6	295.3	293.5	0.64	2849.	N/A	N/A
0.004874	0.004870	0.996651	-.000033	299.5	299.5	295.2	293.6	0.51	2898.	N/A	N/A
0.004914	0.004909	0.996651	-.000033	299.4	299.4	295.3	293.6	0.38	2953.	N/A	N/A
0.004973	0.004968	0.996651	-.000033	299.4	299.3	295.4	293.6	0.25	3000.	N/A	N/A
0.004295	0.004363	0.994784	0.000053	299.1	299.1	295.7	293.6	1.59	3214.	N/A	N/A
0.004260	0.004327	0.994784	0.000053	299.0	299.0	295.7	293.6	1.40	3271.	N/A	N/A
0.004307	0.004374	0.994784	0.000053	299.0	298.9	295.7	293.6	1.14	3326.	N/A	N/A
0.004450	0.004518	0.994784	0.000053	298.9	298.9	295.8	293.6	0.89	3380.	N/A	N/A
0.004456	0.004524	0.994784	0.000053	298.9	298.8	295.8	293.6	0.76	3430.	N/A	N/A
0.004555	0.004622	0.994784	0.000053	298.8	298.8	295.7	293.6	0.64	3481.	N/A	N/A
0.004656	0.004723	0.994784	0.000053	298.8	298.7	295.7	293.6	0.51	3530.	N/A	N/A
0.004733	0.004799	0.994784	0.000053	298.7	298.7	295.8	293.6	0.38	3581.	N/A	N/A
0.004788	0.004854	0.994784	0.000053	298.7	298.6	296.0	293.6	0.25	3631.	N/A	N/A
0.004939	0.005006	0.994784	0.000053	298.6	298.6	296.0	293.6	0.13	3684.	N/A	N/A
0.003415	0.003450	1.009424	0.000007	292.8	292.7	295.3	293.6	1.59	25131.	N/A	N/A
0.003385	0.003419	1.009424	0.000007	292.8	292.7	295.4	293.6	1.40	25189.	N/A	N/A
0.003506	0.003542	1.009424	0.000007	292.8	292.7	295.3	293.6	1.14	25244.	N/A	N/A
0.003575	0.003611	1.009424	0.000007	292.8	292.7	295.3	293.6	0.89	25297.	N/A	N/A
0.003776	0.003814	1.009424	0.000007	292.8	292.7	295.4	293.6	0.64	25351.	N/A	N/A
0.003805	0.003843	1.009424	0.000007	292.8	292.7	295.3	293.6	0.51	25403.	N/A	N/A
0.003859	0.003897	1.009424	0.000007	292.8	292.7	295.4	293.6	0.38	25455.	N/A	N/A
0.004004	0.004044	1.009424	0.000007	292.8	292.7	295.5	293.6	0.25	25506.	N/A	N/A
0.004149	0.004189	1.009424	0.000007	292.8	292.7	295.5	293.6	0.13	25557.	N/A	N/A
0.003426	0.003475	1.007668	0.000027	292.9	292.8	295.5	293.6	1.59	25789.	N/A	N/A
0.003328	0.003377	1.007668	0.000027	292.9	292.8	295.4	293.6	1.40	25844.	N/A	N/A
0.003477	0.003527	1.007668	0.000027	292.9	292.8	295.6	293.6	1.14	25894.	N/A	N/A
0.003526	0.003576	1.007668	0.000027	292.9	292.8	295.5	293.6	0.89	25951.	N/A	N/A
0.003649	0.003700	1.007668	0.000027	292.9	292.8	295.3	293.6	0.64	26010.	N/A	N/A
0.003825	0.003878	1.007668	0.000027	292.9	292.9	295.5	293.6	0.38	26058.	N/A	N/A
0.004136	0.004190	1.007668	0.000027	292.9	292.9	295.4	293.6	0.13	26106.	N/A	N/A
0.002337	0.003209	1.001896	0.000868	293.9	293.9	295.2	293.6	1.59	83821.	N/A	N/A
0.002272	0.002414	1.002567	0.000135	294.0	293.9	295.4	293.6	1.52	84083.	N/A	N/A
0.002263	0.002405	1.002567	0.000135	293.9	293.9	295.4	293.6	1.40	84145.	N/A	N/A
0.002284	0.002426	1.002567	0.000135	294.0	293.9	295.6	293.6	1.27	84204.	N/A	N/A
0.002328	0.002470	1.002567	0.000135	294.0	293.9	295.5	293.6	1.14	84256.	N/A	N/A
0.002313	0.002455	1.002567	0.000135	294.0	293.9	295.4	293.6	1.02	84311.	N/A	N/A
0.002436	0.002578	1.002567	0.000135	293.9	293.9	295.5	293.6	0.89	84369.	N/A	N/A
0.002417	0.002559	1.002567	0.000135	293.9	293.9	295.5	293.6	0.76	84456.	N/A	N/A
0.002492	0.002635	1.002567	0.000135	293.9	293.9	295.6	293.6	0.64	84513.	N/A	N/A
0.002559	0.002702	1.002567	0.000135	293.9	293.9	295.4	293.6	0.51	84590.	N/A	N/A
0.002583	0.002725	1.002567	0.000135	294.0	293.9	295.5	293.6	0.38	84641.	N/A	N/A
0.002656	0.002799	1.002567	0.000135	293.9	293.9	295.6	293.6	0.25	84697.	N/A	N/A
0.002766	0.002909	1.002567	0.000135	294.0	293.9	295.5	293.6	0.13	84755.	N/A	N/A
0.002256	0.002399	1.002415	0.000137	294.1	294.0	295.6	293.6	1.59	85420.	N/A	N/A
0.002223	0.002366	1.002415	0.000137	294.1	294.0	295.4	293.6	1.52	85482.	N/A	N/A
0.002229	0.002373	1.002415	0.000137	294.1	294.0	295.4	293.6	1.40	85542.	N/A	N/A
0.002258	0.002402	1.002415	0.000137	294.1	294.0	295.4	293.6	1.27	85595.	N/A	N/A
0.002341	0.002485	1.002415	0.000137	294.1	294.0	295.5	293.6	1.14	85648.	N/A	N/A
0.002334	0.002478	1.002415	0.000137	294.1	294.0	295.5	293.6	1.02	85697.	N/A	N/A

Table H.1.7 Diesel contamination on oxidized copper surface for Re = 0 and x_b = 0.3 %

Diesel contamination on oxidized copper surface for Re = 0 and x_b = 0.3 % (file:trv0con2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.004440	0.004456	1.007538	-0.000029	295.4	295.4	294.5	293.7	1.59	2476.	0.0000	0.0626
0.004311	0.004326	1.007538	-0.000029	295.4	295.4	294.6	293.7	1.52	2532.	0.0000	0.0627
0.004040	0.004052	1.007538	-0.000029	295.4	295.3	294.5	293.7	1.40	2592.	0.0000	0.0626
0.003770	0.003779	1.007538	-0.000029	295.4	295.3	294.4	293.7	1.27	2647.	0.0000	0.0626
0.003469	0.003475	1.007538	-0.000029	295.4	295.3	294.5	293.7	1.14	2702.	0.0000	0.0626
0.003200	0.003204	1.007538	-0.000029	295.3	295.3	294.5	293.7	1.02	2763.	0.0000	0.0627
0.002949	0.002949	1.007538	-0.000029	295.3	295.3	294.4	293.7	0.89	2823.	0.0000	0.0626
0.002672	0.002670	1.007538	-0.000029	295.3	295.3	294.4	293.7	0.76	2880.	0.0000	0.0626
0.002325	0.002319	1.007538	-0.000029	295.3	295.3	294.4	293.7	0.64	2939.	0.0000	0.0626
0.002060	0.002052	1.007538	-0.000029	295.3	295.2	294.4	293.7	0.51	3000.	0.0000	0.0626
0.001739	0.001727	1.007538	-0.000029	295.3	295.2	294.4	293.7	0.38	3056.	0.0000	0.0626
0.001418	0.001404	1.007538	-0.000029	295.3	295.2	294.5	293.7	0.25	3118.	0.0000	0.0627
0.001074	0.001055	1.007538	-0.000029	295.3	295.2	294.6	293.7	0.13	3178.	0.0000	0.0626
0.004750	0.004793	1.009045	-0.000006	294.4	294.8	294.1	293.7	1.59	406841.	0.0000	0.0713
0.004606	0.004648	1.009045	-0.000006	294.4	294.7	294.1	293.7	1.52	406899.	0.0000	0.0792
0.004393	0.004432	1.009045	-0.000006	294.4	294.8	294.1	293.7	1.40	406954.	0.0000	0.0741
0.004173	0.004211	1.009045	-0.000006	294.4	294.8	294.1	293.7	1.27	407010.	0.0000	0.0734
0.003978	0.004013	1.009045	-0.000006	294.4	294.7	294.1	293.7	1.14	407065.	0.0000	0.0807
0.003783	0.003816	1.009045	-0.000006	294.4	294.8	294.1	293.7	1.02	407122.	0.0000	0.0793
0.003533	0.003564	1.009045	-0.000006	294.4	294.8	294.2	293.7	0.89	407178.	0.0000	0.0808
0.003261	0.003289	1.009045	-0.000006	294.4	294.8	294.1	293.7	0.76	407234.	0.0000	0.0738
0.003042	0.003067	1.009045	-0.000006	294.4	294.8	294.1	293.7	0.64	407289.	0.0000	0.0788
0.002831	0.002854	1.009045	-0.000006	294.4	294.8	294.1	293.7	0.51	407354.	0.0000	0.0823
0.002561	0.002581	1.009045	-0.000006	294.4	294.8	294.1	293.7	0.38	407410.	0.0000	0.0779
0.002334	0.002352	1.009045	-0.000006	294.4	294.8	294.1	293.7	0.25	407466.	0.0000	0.0794
0.001987	0.002001	1.009045	-0.000006	294.4	294.8	294.1	293.7	0.13	407521.	0.0000	0.0817
0.005085	0.005157	1.000987	0.000058	294.5	294.9	294.3	293.7	1.59	410253.	0.0000	0.0793
0.005006	0.005077	1.000987	0.000058	294.5	294.9	294.2	293.7	1.52	410306.	0.0000	0.0785
0.004853	0.004923	1.000987	0.000058	294.5	294.9	294.3	293.7	1.40	410359.	0.0000	0.0755
0.004663	0.004733	1.000987	0.000058	294.5	294.9	294.2	293.7	1.27	410412.	0.0000	0.0803
0.004474	0.004544	1.000987	0.000058	294.5	294.9	294.2	293.7	1.14	410468.	0.0000	0.0799
0.004302	0.004371	1.000987	0.000058	294.5	294.9	294.3	293.7	1.02	410522.	0.0000	0.0747
0.004080	0.004149	1.000987	0.000058	294.5	294.9	294.2	293.7	0.89	410577.	0.0000	0.0721
0.003813	0.003881	1.000987	0.000058	294.5	294.9	294.2	293.7	0.76	410632.	0.0000	0.0768
0.003700	0.003768	1.000987	0.000058	294.5	294.9	294.3	293.7	0.64	410685.	0.0000	0.0627
0.003460	0.003527	1.000987	0.000058	294.5	294.9	294.3	293.7	0.51	410739.	0.0000	0.0627
0.003296	0.003363	1.000987	0.000058	294.5	294.9	294.3	293.7	0.38	410798.	0.0000	0.0627
0.003000	0.003066	1.000987	0.000058	294.5	294.9	294.3	293.7	0.25	410853.	0.0000	0.0627
0.002693	0.002758	1.000987	0.000058	294.5	294.9	294.3	293.7	0.13	410915.	0.0000	0.0627
0.005401	0.005435	1.003869	0.000004	294.6	295.1	294.2	293.7	1.59	414268.	0.0000	0.0740
0.005254	0.005287	1.003869	0.000004	294.6	295.1	294.2	293.7	1.52	414324.	0.0000	0.0789
0.005067	0.005099	1.003869	0.000004	294.6	295.1	294.2	293.7	1.40	414380.	0.0000	0.0780
0.004929	0.004961	1.003869	0.000004	294.6	295.1	294.2	293.7	1.27	414435.	0.0000	0.0705
0.004675	0.004706	1.003869	0.000004	294.6	295.1	294.2	293.7	1.14	414494.	0.0000	0.0691
0.004599	0.004629	1.003869	0.000004	294.6	295.1	294.2	293.7	1.02	414545.	0.0000	0.0627
0.004409	0.004438	1.003869	0.000004	294.6	295.1	294.2	293.7	0.89	414605.	0.0000	0.0724
0.004208	0.004236	1.003869	0.000004	294.6	295.1	294.2	293.7	0.76	414662.	0.0000	0.0627
0.004000	0.004026	1.003869	0.000004	294.6	295.1	294.2	293.7	0.64	414717.	0.0000	0.0627
0.003820	0.003845	1.003869	0.000004	294.6	295.1	294.2	293.7	0.51	414775.	0.0000	0.0691
0.003647	0.003672	1.003869	0.000004	294.6	295.1	294.2	293.7	0.38	414834.	0.0000	0.0727
0.003382	0.003405	1.003869	0.000004	294.6	295.1	294.2	293.7	0.25	414889.	0.0000	0.0698
0.003199	0.003221	1.003869	0.000004	294.6	295.1	294.2	293.7	0.13	414947.	0.0000	0.0627
0.005584	0.005656	1.003422	0.000044	294.6	295.1	294.3	293.7	1.59	418388.	0.0000	0.0627
0.005722	0.005796	1.003422	0.000044	294.6	295.1	294.3	293.7	1.52	418457.	0.0000	0.0627
0.005533	0.005605	1.003422	0.000044	294.6	295.1	294.3	293.7	1.40	418510.	0.0000	0.0627
0.005359	0.005431	1.003422	0.000044	294.6	295.1	294.3	293.7	1.27	418565.	0.0000	0.0627
0.005183	0.005254	1.003422	0.000044	294.6	295.1	294.2	293.7	1.14	418620.	0.0000	0.0627
0.005061	0.005131	1.003422	0.000044	294.6	295.1	294.2	293.7	1.02	418674.	0.0000	0.0627

Table H.1.8 Diesel contamination on oxidized copper surface for Re = 2000 and x_b = 0.3 %

Diesel contamination on oxidized copper surface for Re = 2000 and x_b = 0.3 % (file:trv15con2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.0035970	0.0036550	1.005509	0.0000330	294.6	294.4	294.3	293.7	1.59	613.	0.0906	0.0623
0.003322	0.003378	1.005509	0.000033	294.6	294.4	294.7	293.7	1.52	749.	0.0931	0.0623
0.003042	0.003096	1.005509	0.000033	294.6	294.4	294.4	293.7	1.40	792.	0.0942	0.0623
0.002723	0.002775	1.005509	0.000033	294.6	294.4	294.8	293.7	1.27	837.	0.0904	0.0623
0.002429	0.002479	1.005509	0.000033	294.6	294.4	294.6	293.7	1.14	881.	0.0909	0.0623
0.002193	0.002241	1.005509	0.000033	294.5	294.4	294.7	293.7	1.02	922.	0.0942	0.0623
0.001812	0.001857	1.005509	0.000033	294.5	294.4	294.7	293.6	0.89	966.	0.0952	0.0623
0.001578	0.001622	1.005509	0.000033	294.5	294.4	294.6	293.7	0.76	1008.	0.0935	0.0623
0.001261	0.001303	1.005509	0.000033	294.5	294.4	294.4	293.7	0.64	1054.	0.0920	0.0623
0.000910	0.000949	1.005509	0.000033	294.5	294.4	294.4	293.7	0.51	1097.	0.0943	0.0623
0.000618	0.000656	1.005509	0.000033	294.5	294.4	294.3	293.7	0.38	1138.	0.0887	0.0623
0.000226	0.000261	1.005509	0.000033	294.4	294.4	294.7	293.7	0.25	1181.	0.0952	0.0623
-0.000086	-0.000054	1.005509	0.000033	294.4	294.4	294.2	293.7	0.13	1226.	0.0926	0.0623
0.003653	0.003637	1.003232	-0.000032	294.4	294.3	294.5	293.7	1.59	1374.	0.0933	0.0623
0.003463	0.003446	1.003232	-0.000032	294.4	294.3	294.3	293.7	1.52	1422.	0.0900	0.0623
0.003191	0.003172	1.003232	-0.000032	294.3	294.3	294.5	293.7	1.40	1468.	0.0942	0.0623
0.002991	0.002972	1.003232	-0.000032	294.3	294.3	294.0	293.7	1.27	1513.	0.0945	0.0623
0.002751	0.002730	1.003232	-0.000032	294.3	294.2	294.7	293.7	1.14	1557.	0.0896	0.0623
0.002472	0.002451	1.003232	-0.000032	294.3	294.2	294.6	293.6	1.02	1606.	0.0906	0.0623
0.002169	0.002146	1.003232	-0.000032	294.2	294.2	294.4	293.7	0.89	1652.	0.0939	0.0623
0.001908	0.001884	1.003232	-0.000032	294.2	294.2	294.4	293.7	0.76	1694.	0.0934	0.0623
0.001576	0.001550	1.003232	-0.000032	294.2	294.1	294.4	293.7	0.64	1739.	0.0914	0.0623
0.001306	0.001279	1.003232	-0.000032	294.2	294.1	294.2	293.7	0.51	1786.	0.0916	0.0623
0.001026	0.000998	1.003232	-0.000032	294.1	294.1	294.2	293.6	0.38	1831.	0.0879	0.0623
0.000778	0.000749	1.003232	-0.000032	294.1	294.1	294.4	293.7	0.25	1875.	0.0936	0.0623
0.000533	0.000503	1.003232	-0.000032	294.1	294.1	294.5	293.7	0.13	1919.	0.0892	0.0623
0.012290	0.012345	1.004488	0.000009	293.3	293.2	294.2	293.7	1.59	5348.	0.0890	0.0623
0.012646	0.012703	1.004488	0.000009	293.3	293.2	294.2	293.7	1.52	5391.	0.0890	0.0623
0.012457	0.012514	1.004488	0.000009	293.3	293.2	294.1	293.7	1.40	5440.	0.0909	0.0623
0.012575	0.012632	1.004488	0.000009	293.3	293.3	294.2	293.7	1.27	5485.	0.0846	0.0623
0.013596	0.013657	1.004488	0.000009	293.3	293.3	294.6	293.6	1.14	5528.	0.0882	0.0623
0.012922	0.012981	1.004488	0.000009	293.3	293.3	294.1	293.7	1.02	5573.	0.0835	0.0623
0.011067	0.011119	1.004488	0.000009	293.4	293.3	294.2	293.7	0.89	5620.	0.0877	0.0623
0.009262	0.009308	1.004488	0.000009	293.4	293.3	294.0	293.6	0.76	5667.	0.0891	0.0623
0.009017	0.009061	1.004488	0.000009	293.4	293.3	294.6	293.7	0.64	5712.	0.0857	0.0623
0.009151	0.009196	1.004488	0.000009	293.4	293.4	294.6	293.7	0.51	5756.	0.0839	0.0623
0.009208	0.009254	1.004488	0.000009	293.4	293.4	294.5	293.7	0.38	5804.	0.0856	0.0623
0.009529	0.009577	1.004488	0.000009	293.4	293.4	294.3	293.7	0.25	5855.	0.0873	0.0623
0.010371	0.010423	1.004488	0.000009	293.5	293.4	294.6	293.7	0.13	5910.	0.0827	0.0623
0.018959	0.019067	1.005701	0.000000	293.7	293.6	294.4	293.7	1.59	11545.	0.0909	0.0623
0.019063	0.019172	1.005701	0.000000	293.7	293.7	294.2	293.7	1.52	11590.	0.0906	0.0623
0.019103	0.019213	1.005701	0.000000	293.7	293.7	294.2	293.7	1.40	11635.	0.0905	0.0623
0.019066	0.019176	1.005701	0.000000	293.7	293.7	294.5	293.7	1.27	11678.	0.0897	0.0623
0.019079	0.019190	1.005701	0.000000	293.8	293.7	294.6	293.7	1.14	11723.	0.0905	0.0623
0.018951	0.019062	1.005701	0.000000	293.8	293.8	294.4	293.6	1.02	11769.	0.0909	0.0623
0.017200	0.017301	1.005701	0.000000	293.8	293.8	294.2	293.7	0.89	11820.	0.0919	0.0623
0.015048	0.015137	1.005701	0.000000	293.8	293.8	294.4	293.7	0.76	11885.	0.0907	0.0623
0.013818	0.013900	1.005701	0.000000	293.9	293.8	294.6	293.6	0.64	11937.	0.0925	0.0623
0.013441	0.013522	1.005701	0.000000	293.9	293.8	294.3	293.7	0.51	11982.	0.0910	0.0623
0.013486	0.013567	1.005701	0.000000	293.9	293.9	294.2	293.6	0.38	12028.	0.0872	0.0623
0.013593	0.013675	1.005701	0.000000	293.9	293.9	294.6	293.6	0.25	12073.	0.0865	0.0623
0.013592	0.013673	1.005701	0.000000	293.9	293.9	294.5	293.7	0.13	12118.	0.0895	0.0623
0.013199	0.013298	1.004021	0.000041	293.9	293.9	294.2	293.7	1.59	12289.	0.0925	0.0623
0.013292	0.013391	1.004021	0.000041	293.9	293.9	294.8	293.6	1.52	12336.	0.0868	0.0623
0.013225	0.013324	1.004021	0.000041	293.9	293.9	294.7	293.6	1.40	12382.	0.0901	0.0623
0.013196	0.013295	1.004021	0.000041	293.9	293.9	294.8	293.7	1.27	12433.	0.0901	0.0623

Table H.1.9 Diesel contamination on oxidized copper surface for Re = 4000 and x_b = 0.3 %

Diesel contamination on oxidized copper surface for Re = 4000 and x_b = 0.3 % (file:trv3con2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.011072	0.011157	1.004420	00.000033	293.9	293.9	293.9	293.7	1.59	64840.	0.1899	0.1835
0.010992	0.011077	1.004420	0.000033	293.9	293.9	293.9	293.7	1.52	64910.	0.1952	0.1842
0.010911	0.010995	1.004420	0.000033	293.9	293.9	293.9	293.7	1.40	64953.	0.1946	0.1841
0.010948	0.011031	1.004420	0.000033	293.8	293.8	293.9	293.7	1.27	65012.	0.1887	0.1821
0.010886	0.010968	1.004420	0.000033	293.8	293.8	293.9	293.7	1.14	65079.	0.1922	0.1690
0.010847	0.010929	1.004420	0.000033	293.8	293.8	293.9	293.7	1.02	65125.	0.1927	0.1730
0.010797	0.010878	1.004420	0.000033	293.8	293.8	293.9	293.7	0.89	65175.	0.1940	0.1940
0.010634	0.010714	1.004420	0.000033	293.8	293.8	294.1	293.7	0.76	65229.	0.1934	0.2099
0.010665	0.010745	1.004420	0.000033	293.7	293.7	293.9	293.7	0.64	65299.	0.1983	0.2010
0.010695	0.010775	1.004420	0.000033	293.7	293.7	294.0	293.7	0.51	65349.	0.1922	0.1997
0.010746	0.010825	1.004420	0.000033	293.6	293.6	294.0	293.7	0.38	65421.	0.1910	0.2042
0.010743	0.010821	1.004420	0.000033	293.6	293.6	293.9	293.7	0.25	65505.	0.1977	0.1811
0.010748	0.010825	1.004420	0.000033	293.5	293.5	293.9	293.7	0.13	65555.	0.1887	0.1470
0.011404	0.011431	1.003228	-0.000015	294.0	293.9	293.9	293.7	1.59	68691.	0.1910	0.1550
0.011317	0.011343	1.003228	-0.000015	293.9	293.9	293.9	293.7	1.52	68759.	0.1958	0.1605
0.011275	0.011301	1.003228	-0.000015	293.9	293.9	293.9	293.7	1.40	68808.	0.1989	0.1385
0.011285	0.011311	1.003228	-0.000015	293.9	293.9	293.9	293.7	1.27	68854.	0.1910	0.1457
0.011252	0.011278	1.003228	-0.000015	293.9	293.9	293.9	293.7	1.14	68898.	0.1853	0.1799
0.011261	0.011286	1.003228	-0.000015	293.9	293.9	294.0	293.7	1.02	68943.	0.1964	0.1686
0.011191	0.011215	1.003228	-0.000015	293.8	293.8	294.0	293.7	0.89	69033.	0.1934	0.1802
0.011306	0.011331	1.003228	-0.000015	293.8	293.8	293.9	293.7	0.76	69084.	0.1893	0.1982
0.011366	0.011390	1.003228	-0.000015	293.8	293.8	293.9	293.7	0.64	69132.	0.1940	0.1949
0.011243	0.011266	1.003228	-0.000015	293.8	293.8	293.9	293.7	0.51	69177.	0.1916	0.1955
0.011259	0.011282	1.003228	-0.000015	293.8	293.7	294.0	293.7	0.38	69225.	0.1843	0.2035
0.011345	0.011368	1.003228	-0.000015	293.7	293.7	293.9	293.7	0.25	69274.	0.1922	0.2078
0.011269	0.011292	1.003228	-0.000015	293.7	293.7	294.0	293.7	0.13	69322.	0.1910	0.2029
0.011701	0.011696	1.006369	-0.000084	293.9	293.9	294.1	293.7	1.59	72093.	0.1922	0.1646
0.011799	0.011796	1.006369	-0.000084	293.9	293.9	294.1	293.7	1.52	72139.	0.1946	0.1650
0.011717	0.011713	1.006369	-0.000084	293.9	293.9	294.1	293.7	1.40	72186.	0.1945	0.1533
0.011791	0.011788	1.006369	-0.000084	293.9	293.9	294.1	293.7	1.27	72236.	0.1893	0.1609
0.011637	0.011633	1.006369	-0.000084	294.0	293.9	294.1	293.7	1.14	72284.	0.1951	0.1636
0.011679	0.011675	1.006369	-0.000084	294.0	293.9	294.1	293.7	1.02	72331.	0.1952	0.1873
0.011720	0.011717	1.006369	-0.000084	294.0	293.9	294.1	293.7	0.89	72379.	0.1853	0.2214
0.011621	0.011617	1.006369	-0.000084	294.0	294.0	294.1	293.7	0.76	72428.	0.1927	0.2032
0.011719	0.011716	1.006369	-0.000084	294.0	293.9	294.1	293.7	0.64	72482.	0.1865	0.1756
0.011645	0.011641	1.006369	-0.000084	294.0	293.9	294.0	293.7	0.51	72531.	0.1945	0.1689
0.011779	0.011776	1.006369	-0.000084	294.0	294.0	294.0	293.7	0.38	72577.	0.1881	0.1765
0.011726	0.011723	1.006369	-0.000084	293.9	293.9	294.0	293.7	0.25	72621.	0.1977	0.1734
0.011862	0.011860	1.006369	-0.000084	293.9	293.9	294.0	293.7	0.13	72668.	0.1904	0.1744
0.012166	0.012227	1.008294	-0.000045	294.0	293.9	294.1	293.7	1.59	76231.	0.1945	0.1881
0.012174	0.012236	1.008294	-0.000045	294.0	293.9	294.1	293.7	1.52	76278.	0.1922	0.1710
0.012214	0.012276	1.008294	-0.000045	294.0	293.9	294.1	293.7	1.40	76326.	0.1837	0.1822
0.012061	0.012121	1.008294	-0.000045	294.0	294.0	294.1	293.7	1.27	76375.	0.1898	0.1925
0.012127	0.012188	1.008294	-0.000045	294.0	293.9	294.1	293.7	1.14	76421.	0.1910	0.1880
0.012160	0.012222	1.008294	-0.000045	294.0	293.9	294.1	293.7	1.02	76475.	0.1934	0.1821
0.012168	0.012230	1.008294	-0.000045	294.0	294.0	294.2	293.7	0.89	76523.	0.1934	0.1814
0.012160	0.012222	1.008294	-0.000045	294.0	293.9	294.1	293.7	0.76	76568.	0.1853	0.1850
0.012271	0.012333	1.008294	-0.000045	294.0	293.9	294.1	293.7	0.64	76613.	0.1859	0.1863
0.012255	0.012318	1.008294	-0.000045	294.0	293.9	294.2	293.7	0.51	76659.	0.1934	0.1865
0.012299	0.012361	1.008294	-0.000045	294.0	293.9	294.1	293.7	0.38	76707.	0.1983	0.1735
0.012432	0.012495	1.008294	-0.000045	293.9	293.9	294.1	293.7	0.25	76755.	0.1983	0.1723
0.012438	0.012501	1.008294	-0.000045	293.9	293.9	294.2	293.7	0.13	76826.	0.1934	0.1663
0.012171	0.012131	1.004779	-0.000097	293.6	293.5	294.3	293.7	1.59	79482.	0.1952	0.1872
0.012184	0.012144	1.004779	-0.000097	293.6	293.5	294.3	293.7	1.52	79525.	0.1899	0.1769
0.012254	0.012216	1.004779	-0.000097	293.6	293.6	294.2	293.7	1.40	79573.	0.1910	0.1438
0.012222	0.012183	1.004779	-0.000097	293.6	293.6	294.2	293.7	1.27	79620.	0.1848	0.1511

Table H.1.10 Diesel contamination on oxidized copper surface for Re = 5000 and x_b = 0.3 %

Diesel contamination on oxidized copper surface for Re = 5000 and x_b = 0.3 % (file:trv45con2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.004208	0.004205	0.993235	00.000034	292.4	292.4	295.4	293.7	1.59	4061.	0.2420	0.2266
0.004008	0.004007	0.993235	0.000034	292.4	292.4	295.3	293.7	1.52	4103.	0.2488	0.2322
0.003698	0.003700	0.993235	0.000034	292.5	292.5	295.2	293.7	1.40	4144.	0.2488	0.2378
0.003431	0.003435	0.993235	0.000034	292.5	292.5	294.6	293.7	1.27	4187.	0.2497	0.2440
0.003121	0.003128	0.993235	0.000034	292.6	292.5	294.4	293.7	1.14	4229.	0.2420	0.2478
0.002796	0.002806	0.993235	0.000034	292.6	292.6	294.9	293.7	1.02	4271.	0.2458	0.2502
0.002473	0.002486	0.993235	0.000034	292.6	292.6	295.4	293.7	0.89	4315.	0.2458	0.2462
0.002210	0.002226	0.993235	0.000034	292.7	292.6	295.1	293.7	0.76	4360.	0.2507	0.2210
0.001853	0.001871	0.993235	0.000034	292.7	292.7	295.7	293.7	0.64	4402.	0.2528	0.2271
0.001530	0.001551	0.993235	0.000034	292.8	292.7	295.8	293.7	0.51	4444.	0.2449	0.2448
0.001180	0.001204	0.993235	0.000034	292.8	292.8	295.6	293.7	0.38	4488.	0.2401	0.2488
0.000923	0.000950	0.993235	0.000034	292.8	292.8	295.5	293.7	0.25	4530.	0.2338	0.2444
0.000681	0.000709	0.993235	0.000034	292.9	292.9	295.7	293.7	0.13	4574.	0.2508	0.2383
0.004110	0.004058	0.989872	-0.000007	293.1	293.0	294.7	293.7	1.59	4733.	0.2497	0.2248
0.003916	0.003865	0.989872	-0.000007	293.1	293.1	295.0	293.7	1.52	4776.	0.2487	0.2322
0.003659	0.003612	0.989872	-0.000007	293.1	293.1	296.1	293.7	1.40	4819.	0.2401	0.2489
0.003347	0.003304	0.989872	-0.000007	293.2	293.1	295.7	293.7	1.27	4862.	0.2458	0.2416
0.003064	0.003024	0.989872	-0.000007	293.2	293.2	296.3	293.7	1.14	4903.	0.2392	0.2417
0.002810	0.002772	0.989872	-0.000007	293.2	293.2	296.2	293.7	1.02	4948.	0.2478	0.2329
0.002424	0.002391	0.989872	-0.000007	293.3	293.3	295.4	293.7	0.89	4990.	0.2402	0.2246
0.002123	0.002093	0.989872	-0.000007	293.3	293.3	295.2	293.7	0.76	5032.	0.2478	0.2041
0.001808	0.001782	0.989872	-0.000007	293.4	293.3	294.8	293.7	0.64	5077.	0.2402	0.2124
0.001516	0.001493	0.989872	-0.000007	293.4	293.4	296.0	293.7	0.51	5121.	0.2468	0.2318
0.001248	0.001228	0.989872	-0.000007	293.4	293.4	295.8	293.6	0.38	5163.	0.2402	0.2284
0.000887	0.000871	0.989872	-0.000007	293.5	293.4	295.8	293.7	0.25	5205.	0.2339	0.2381
0.000559	0.000546	0.989872	-0.000007	293.5	293.5	295.9	293.7	0.13	5247.	0.2467	0.2513
0.004139	0.004004	0.984469	-0.000074	294.4	294.4	295.9	293.7	1.59	7217.	0.2383	0.2167
0.004077	0.003944	0.984469	-0.000074	294.4	294.4	295.8	293.7	1.52	7260.	0.2374	0.2182
0.003855	0.003725	0.984469	-0.000074	294.3	294.3	295.9	293.7	1.40	7312.	0.2497	0.2093
0.003594	0.003468	0.984469	-0.000074	294.3	294.3	295.9	293.7	1.27	7363.	0.2401	0.2119
0.003310	0.003187	0.984469	-0.000074	294.3	294.3	295.8	293.7	1.14	7418.	0.2448	0.2173
0.002939	0.002822	0.984469	-0.000074	294.3	294.3	295.8	293.7	1.02	7466.	0.2497	0.2195
0.002658	0.002545	0.984469	-0.000074	294.3	294.3	296.1	293.7	0.89	7510.	0.2476	0.2221
0.002330	0.002222	0.984469	-0.000074	294.3	294.3	296.0	293.7	0.76	7553.	0.2467	0.2251
0.002069	0.001965	0.984469	-0.000074	294.3	294.2	296.0	293.7	0.64	7596.	0.2497	0.2678
0.001724	0.001625	0.984469	-0.000074	294.3	294.2	296.1	293.7	0.51	7638.	0.2497	0.2355
0.001494	0.001398	0.984469	-0.000074	294.2	294.2	295.7	293.7	0.38	7682.	0.2517	0.2429
0.001162	0.001071	0.984469	-0.000074	294.2	294.2	295.3	293.7	0.25	7724.	0.2400	0.2493
0.000913	0.000826	0.984469	-0.000074	294.2	294.2	295.9	293.7	0.13	7767.	0.2429	0.2530
0.003987	0.004049	1.005697	0.000037	294.1	294.0	296.5	293.7	1.59	72772.	0.2558	0.2324
0.003930	0.003992	1.005697	0.000037	294.1	294.0	296.3	293.7	1.52	72816.	0.2558	0.2511
0.003774	0.003835	1.005697	0.000037	294.1	294.0	296.4	293.6	1.40	72863.	0.2569	0.2579
0.003574	0.003634	1.005697	0.000037	294.1	294.1	296.7	293.7	1.27	72904.	0.2476	0.2651
0.003399	0.003458	1.005697	0.000037	294.1	294.1	296.4	293.7	1.14	72945.	0.2622	0.2697
0.003093	0.003149	1.005697	0.000037	294.1	294.1	296.4	293.7	1.02	72988.	0.2601	0.2501
0.002719	0.002774	1.005697	0.000037	294.1	294.1	296.3	293.7	0.89	73030.	0.2548	0.2617
0.002359	0.002411	1.005697	0.000037	294.1	294.1	296.3	293.7	0.76	73071.	0.2569	0.2594
0.002145	0.002196	1.005697	0.000037	294.1	294.1	296.4	293.7	0.64	73115.	0.2548	0.2626
0.001927	0.001977	1.005697	0.000037	294.1	294.1	296.4	293.7	0.51	73157.	0.2590	0.2634
0.001635	0.001683	1.005697	0.000037	294.1	294.1	296.4	293.7	0.38	73202.	0.2611	0.2676
0.001386	0.001432	1.005697	0.000037	294.1	294.1	296.6	293.7	0.25	73245.	0.2458	0.2695
0.001104	0.001149	1.005697	0.000037	294.1	294.1	296.5	293.7	0.13	73286.	0.2537	0.2679
0.004063	0.004069	1.008256	-0.000031	294.1	294.1	296.8	293.7	1.59	73421.	0.2477	0.2603
0.003791	0.003794	1.008256	-0.000031	294.1	294.1	296.5	293.7	1.52	73462.	0.2634	0.2560
0.003890	0.003893	1.008256	-0.000031	294.1	294.1	296.3	293.7	1.40	73506.	0.2611	0.2613
0.003280	0.003278	1.008256	-0.000031	294.1	294.1	296.5	293.7	1.27	73548.	0.2506	0.2641
0.003152	0.003149	1.008256	-0.000031	294.1	294.0	296.6	293.7	1.14	73591.	0.2487	0.2619

Table H.1.11 Diesel contamination on oxidized copper surface for Re = 7000 and x_b = 0.3 %

Diesel contamination on oxidized copper surface for Re = 7000 and x_b = 0.3 % (file:trv6con2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
0.013240	0.013403	1.004572	0.000105	293.6	293.6	294.5	293.7	1.59	63545.	0.3372	0.0624
0.015901	0.016076	1.004572	0.000105	293.6	293.6	294.5	293.7	1.52	63592.	0.3354	0.0624
0.013409	0.013573	1.004572	0.000105	293.6	293.6	294.6	293.7	1.40	63638.	0.3372	0.3744
0.010815	0.010968	1.004572	0.000105	293.7	293.6	294.5	293.7	1.27	63685.	0.3198	0.0625
0.012913	0.013076	1.004572	0.000105	293.7	293.7	294.5	293.7	1.14	63734.	0.3182	0.0624
0.009349	0.009496	1.004572	0.000105	293.7	293.7	294.5	293.7	1.02	63782.	0.3150	0.0654
0.009588	0.009737	1.004572	0.000105	293.8	293.7	294.6	293.7	0.89	63831.	0.3265	0.0624
0.007571	0.007712	1.004572	0.000105	293.8	293.8	294.6	293.7	0.76	63880.	0.3248	0.0624
0.006367	0.006503	1.004572	0.000105	293.8	293.8	294.6	293.7	0.64	63929.	0.3389	0.0624
0.006039	0.006174	1.004572	0.000105	293.9	293.8	294.5	293.6	0.51	63980.	0.3102	0.0624
0.004005	0.004130	1.004572	0.000105	293.9	293.9	294.6	293.7	0.38	64031.	0.3299	0.3531
0.003336	0.003458	1.004572	0.000105	293.9	293.9	294.6	293.6	0.25	64083.	0.3407	0.0624
0.004463	0.004590	1.004572	0.000105	293.9	293.9	294.5	293.6	0.13	64129.	0.3198	0.0624
0.014031	0.014287	1.009780	0.000126	293.5	293.5	294.6	293.7	1.59	67123.	0.3246	0.0624
0.015226	0.015493	1.009780	0.000126	293.5	293.5	294.6	293.7	1.52	67170.	0.3248	0.0624
0.011928	0.012165	1.009780	0.000126	293.4	293.4	294.6	293.7	1.40	67218.	0.3231	0.0625
0.011950	0.012186	1.009780	0.000126	293.4	293.4	294.6	293.7	1.27	67262.	0.3353	0.3073
0.013350	0.013599	1.009780	0.000126	293.4	293.4	294.6	293.7	1.14	67309.	0.3353	0.0624
0.009006	0.009215	1.009780	0.000126	293.4	293.4	294.6	293.7	1.02	67355.	0.3246	0.0626
0.009475	0.009688	1.009780	0.000126	293.4	293.4	294.5	293.7	0.89	67405.	0.3371	0.0624
0.007716	0.007913	1.009780	0.000126	293.4	293.4	294.4	293.7	0.76	67453.	0.3281	0.0624
0.006117	0.006299	1.009780	0.000126	293.4	293.4	294.4	293.7	0.64	67505.	0.3182	0.0628
0.005736	0.005914	1.009780	0.000126	293.4	293.4	294.5	293.7	0.51	67553.	0.3317	0.3902
0.004038	0.004201	1.009780	0.000126	293.4	293.4	294.3	293.7	0.38	67601.	0.3317	0.3837
0.003438	0.003595	1.009780	0.000126	293.4	293.4	294.4	293.7	0.25	67648.	0.3133	0.0624
0.002834	0.002986	1.009780	0.000126	293.4	293.4	294.4	293.7	0.13	67693.	0.3389	0.3960
0.006600	0.006756	1.007389	0.000107	293.7	293.7	294.2	293.7	1.59	71007.	0.3183	0.3181
0.006594	0.006749	1.007389	0.000107	293.6	293.6	294.1	293.7	1.52	71064.	0.3486	0.3096
0.006078	0.006229	1.007389	0.000107	293.6	293.6	294.2	293.7	1.40	71120.	0.3267	0.3206
0.005643	0.005791	1.007389	0.000107	293.6	293.6	294.0	293.7	1.27	71171.	0.3392	0.3277
0.005132	0.005276	1.007389	0.000107	293.6	293.6	294.1	293.7	1.14	71215.	0.3430	0.3223
0.004617	0.004757	1.007389	0.000107	293.5	293.5	294.1	293.7	1.02	71261.	0.3251	0.3223
0.004079	0.004215	1.007389	0.000107	293.5	293.5	294.2	293.7	0.89	71313.	0.3392	0.3417
0.003558	0.003690	1.007389	0.000107	293.5	293.5	294.4	293.7	0.76	71362.	0.3234	0.3463
0.003162	0.003291	1.007389	0.000107	293.5	293.5	294.1	293.7	0.64	71407.	0.3320	0.3249
0.002323	0.002447	1.007389	0.000107	293.5	293.5	294.0	293.7	0.51	71457.	0.3354	0.3325
0.002056	0.002178	1.007389	0.000107	293.4	293.4	294.4	293.7	0.38	71502.	0.3320	0.3336
0.001764	0.001884	1.007389	0.000107	293.4	293.4	294.1	293.7	0.25	71548.	0.3392	0.3316
0.001366	0.001482	1.007389	0.000107	293.4	293.4	294.4	293.7	0.13	71593.	0.3217	0.3290
0.006422	0.006540	1.005913	0.000077	294.0	294.0	294.3	293.7	1.59	74448.	0.3392	0.3111
0.006279	0.006396	1.005913	0.000077	294.0	294.0	294.1	293.7	1.52	74495.	0.3185	0.3107
0.005683	0.005796	1.005913	0.000077	294.0	294.0	294.0	293.7	1.40	74538.	0.3429	0.2996
0.005293	0.005404	1.005913	0.000077	294.0	294.0	294.2	293.7	1.27	74584.	0.3392	0.3098
0.004710	0.004817	1.005913	0.000077	294.0	293.9	294.3	293.7	1.14	74629.	0.3338	0.3120
0.004242	0.004345	1.005913	0.000077	294.0	293.9	294.2	293.7	1.02	74679.	0.3447	0.3138
0.003850	0.003951	1.005913	0.000077	293.9	293.9	294.1	293.7	0.89	74725.	0.3268	0.3178
0.003439	0.003537	1.005913	0.000077	293.9	293.9	294.4	293.7	0.76	74768.	0.3374	0.3251
0.002879	0.002974	1.005913	0.000077	293.9	293.9	294.4	293.7	0.64	74816.	0.3410	0.3271
0.002648	0.002741	1.005913	0.000077	293.9	293.9	294.1	293.7	0.51	74862.	0.3429	0.3340
0.002338	0.002429	1.005913	0.000077	293.9	293.9	294.0	293.7	0.38	74908.	0.3410	0.3447
0.002140	0.002230	1.005913	0.000077	293.8	293.8	294.4	293.7	0.25	74956.	0.3268	0.3455
0.002386	0.002477	1.005913	0.000077	293.8	293.8	294.3	293.7	0.13	75002.	0.3320	0.3456
0.004443	0.004531	1.014729	0.000021	293.9	293.9	294.3	293.7	1.59	79055.	0.3302	0.3190
0.004224	0.004308	1.014729	0.000021	293.9	293.9	294.4	293.7	1.52	79101.	0.3485	0.3097
0.003983	0.004064	1.014729	0.000021	293.9	293.9	294.4	293.7	1.40	79145.	0.3216	0.3186
0.003816	0.003894	1.014729	0.000021	293.9	293.8	294.3	293.7	1.27	79190.	0.3391	0.3295
0.003562	0.003636	1.014729	0.000021	293.8	293.8	294.3	293.7	1.14	79238.	0.3267	0.3324

Table H.1.12 Tap water flushing after Re = 5000 contamination tests at x_b = 0.3 %

Tap water flushing after Re = 5000 contamination tests at x_b = 0.3 % (file:flsh45c2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
00.000048	00.000113	1.007885	00.000065	293.3	293.1	297.0	293.7	1.59	402.	N/A	N/A
-0.000054	0.000010	1.007885	0.000065	292.7	292.5	297.2	293.7	1.52	453.	N/A	N/A
0.000103	0.000169	1.007885	0.000065	292.1	291.9	297.1	293.7	1.40	506.	N/A	N/A
0.000066	0.000131	1.007885	0.000065	291.6	291.4	297.0	293.7	1.27	557.	N/A	N/A
0.000034	0.000099	1.007885	0.000065	291.1	290.9	297.0	293.7	1.14	610.	N/A	N/A
0.000180	0.000245	1.007885	0.000065	290.6	290.5	296.9	293.7	1.02	663.	N/A	N/A
0.000047	0.000111	1.007885	0.000065	290.2	290.0	296.9	293.7	0.89	719.	N/A	N/A
0.000019	0.000083	1.007885	0.000065	289.7	289.5	296.7	293.7	0.76	775.	N/A	N/A
0.000044	0.000108	1.007885	0.000065	289.3	289.1	296.8	293.7	0.64	832.	N/A	N/A
0.000029	0.000093	1.007885	0.000065	289.0	288.8	296.9	293.7	0.51	886.	N/A	N/A
0.000113	0.000177	1.007885	0.000065	288.7	288.6	296.9	293.7	0.38	938.	N/A	N/A
0.000299	0.000363	1.007885	0.000065	288.5	288.4	297.0	293.7	0.25	995.	N/A	N/A
0.000638	0.000702	1.007885	0.000065	288.4	288.3	297.0	293.7	0.13	1053.	N/A	N/A
0.000061	0.000048	1.006992	-0.000012	286.4	286.4	297.0	293.7	1.59	3736.	N/A	N/A
-0.000004	-0.000016	1.006992	-0.000012	286.4	286.4	296.8	293.7	1.52	3787.	N/A	N/A
0.000019	0.000006	1.006992	-0.000012	286.4	286.4	297.0	293.7	1.40	3842.	N/A	N/A
0.000000	-0.000012	1.006992	-0.000012	286.4	286.4	297.2	293.7	1.27	3902.	N/A	N/A
0.000025	0.000013	1.006992	-0.000012	286.4	286.3	297.1	293.7	1.14	3958.	N/A	N/A
0.000029	0.000016	1.006992	-0.000012	286.4	286.4	297.0	293.7	1.02	4013.	N/A	N/A
0.000017	0.000005	1.006992	-0.000012	286.4	286.4	297.0	293.7	0.89	4070.	N/A	N/A
0.000038	0.000026	1.006992	-0.000012	286.4	286.4	297.1	293.7	0.76	4124.	N/A	N/A
0.000029	0.000016	1.006992	-0.000012	286.4	286.4	297.4	293.7	0.64	4180.	N/A	N/A
0.000049	0.000037	1.006992	-0.000012	286.4	286.4	297.0	293.7	0.51	4234.	N/A	N/A
0.000018	0.000006	1.006992	-0.000012	286.4	286.3	297.0	293.7	0.38	4294.	N/A	N/A
0.000023	0.000011	1.006992	-0.000012	286.4	286.4	297.2	293.7	0.25	4349.	N/A	N/A
-0.000002	-0.000014	1.006992	-0.000012	286.4	286.3	297.3	293.7	0.13	4406.	N/A	N/A
-0.000262	-0.000424	1.006313	-0.000164	287.3	287.3	295.0	293.7	1.59	64014.	N/A	N/A
-0.000287	-0.000449	1.006313	-0.000164	287.3	287.3	295.0	293.7	1.52	64064.	N/A	N/A
-0.000282	-0.000443	1.006313	-0.000164	287.3	287.3	295.1	293.6	1.40	64118.	N/A	N/A
-0.000297	-0.000459	1.006313	-0.000164	287.3	287.3	295.0	293.7	1.27	64176.	N/A	N/A
-0.000306	-0.000468	1.006313	-0.000164	287.3	287.3	295.0	293.7	1.14	64239.	N/A	N/A
-0.000310	-0.000471	1.006313	-0.000164	287.3	287.3	295.0	293.7	1.02	64292.	N/A	N/A
-0.000308	-0.000469	1.006313	-0.000164	287.3	287.3	295.1	293.7	0.89	64346.	N/A	N/A
-0.000289	-0.000451	1.006313	-0.000164	287.3	287.3	295.1	293.7	0.76	64398.	N/A	N/A
-0.000298	-0.000460	1.006313	-0.000164	287.3	287.3	295.3	293.7	0.64	64452.	N/A	N/A
-0.000302	-0.000464	1.006313	-0.000164	287.3	287.3	295.4	293.6	0.51	64508.	N/A	N/A
-0.000305	-0.000467	1.006313	-0.000164	287.3	287.3	295.1	293.7	0.38	64560.	N/A	N/A
-0.000313	-0.000474	1.006313	-0.000164	287.3	287.3	295.2	293.7	0.25	64612.	N/A	N/A
-0.000311	-0.000472	1.006313	-0.000164	287.3	287.3	295.1	293.7	0.13	64667.	N/A	N/A
-0.000130	-0.000221	1.003946	-0.000093	287.4	287.3	295.3	293.7	1.59	64866.	N/A	N/A
-0.000142	-0.000233	1.003946	-0.000093	287.4	287.3	295.0	293.7	1.52	64920.	N/A	N/A
-0.000145	-0.000237	1.003946	-0.000093	287.4	287.3	295.3	293.7	1.40	64975.	N/A	N/A
-0.000119	-0.000211	1.003946	-0.000093	287.4	287.3	295.3	293.7	1.27	65027.	N/A	N/A
-0.000142	-0.000234	1.003946	-0.000093	287.4	287.3	295.1	293.7	1.14	65082.	N/A	N/A
-0.000162	-0.000253	1.003946	-0.000093	287.4	287.3	295.1	293.7	1.02	65135.	N/A	N/A
-0.000138	-0.000229	1.003946	-0.000093	287.4	287.3	295.0	293.6	0.89	65188.	N/A	N/A
-0.000132	-0.000224	1.003946	-0.000093	287.4	287.3	295.3	293.7	0.76	65245.	N/A	N/A
-0.000127	-0.000218	1.003946	-0.000093	287.4	287.3	295.2	293.6	0.64	65300.	N/A	N/A
-0.000144	-0.000235	1.003946	-0.000093	287.4	287.3	295.3	293.7	0.51	65351.	N/A	N/A
-0.000139	-0.000230	1.003946	-0.000093	287.4	287.3	295.2	293.6	0.38	65405.	N/A	N/A
-0.000136	-0.000227	1.003946	-0.000093	287.4	287.3	295.1	293.7	0.25	65458.	N/A	N/A
-0.000135	-0.000226	1.003946	-0.000093	287.4	287.3	295.4	293.7	0.13	65513.	N/A	N/A
-0.000254	-0.000184	1.008369	0.000071	287.5	287.5	295.2	293.7	1.59	67977.	N/A	N/A
-0.000289	-0.000218	1.008369	0.000071	287.5	287.5	295.3	293.7	1.52	68028.	N/A	N/A
-0.000286	-0.000216	1.008369	0.000071	287.5	287.5	295.4	293.7	1.40	68086.	N/A	N/A
-0.000299	-0.000228	1.008369	0.000071	287.5	287.5	295.2	293.7	1.27	68139.	N/A	N/A
-0.000294	-0.000224	1.008369	0.000071	287.5	287.5	295.2	293.7	1.14	68190.	N/A	N/A
-0.000283	-0.000213	1.008369	0.000071	287.5	287.5	295.1	293.7	1.02	68242.	N/A	N/A

Table H.1.13 Tap water flushing after Re = 7000 contamination tests at x_b = 0.3 %

Tap water flushing after Re = 7000 contamination tests at x_b = 0.3 % (file:flsh6c2.tbl)											
F (v)	F_r (v)	F_{100} (v)	F_0 (v)	T_{Ti} (K)	T_{To} (K)	T_a (K)	T_b (K)	l (mm)	Exposure time (s)	Turbine meter $\dot{m}_w$ (kg/s)	Doppler meter $\dot{m}_w$ (kg/s)
- 00.000236	- 00.000174	1.005803	00.000064	296.9	296.8	295.4	293.7	1.59	0.	N/A	N/A
-0.000369	-0.000308	1.005803	0.000064	296.0	295.9	295.4	293.7	1.52	56.	N/A	N/A
-0.000370	-0.000309	1.005803	0.000064	295.5	295.4	295.4	293.7	1.40	110.	N/A	N/A
-0.000406	-0.000345	1.005803	0.000064	294.9	294.8	295.4	293.7	1.27	165.	N/A	N/A
-0.000409	-0.000347	1.005803	0.000064	294.3	294.1	295.4	293.7	1.14	218.	N/A	N/A
-0.000421	-0.000359	1.005803	0.000064	293.6	293.5	295.4	293.7	1.02	276.	N/A	N/A
-0.000425	-0.000363	1.005803	0.000064	293.0	292.8	295.4	293.7	0.89	328.	N/A	N/A
-0.000423	-0.000360	1.005803	0.000064	292.1	291.8	295.4	293.7	0.76	383.	N/A	N/A
-0.000438	-0.000375	1.005803	0.000064	290.9	290.7	295.4	293.7	0.64	439.	N/A	N/A
-0.000438	-0.000375	1.005803	0.000064	290.0	289.7	295.4	293.7	0.51	492.	N/A	N/A
-0.000453	-0.000389	1.005803	0.000064	289.2	288.9	295.4	293.7	0.38	544.	N/A	N/A
-0.000411	-0.000347	1.005803	0.000064	288.5	288.3	295.4	293.7	0.25	600.	N/A	N/A
-0.000442	-0.000377	1.005803	0.000064	288.0	287.7	295.4	293.7	0.13	654.	N/A	N/A
0.000007	0.000068	1.010679	0.000062	284.3	284.2	296.1	293.7	1.59	11606.	N/A	N/A
-0.000037	0.000025	1.010679	0.000062	284.3	284.2	296.1	293.7	1.52	11662.	N/A	N/A
-0.000023	0.000038	1.010679	0.000062	284.3	284.2	296.0	293.7	1.40	11753.	N/A	N/A
-0.000025	0.000036	1.010679	0.000062	284.2	284.2	296.0	293.7	1.27	11809.	N/A	N/A
-0.000035	0.000026	1.010679	0.000062	284.2	284.2	296.1	293.7	1.14	11862.	N/A	N/A
-0.000033	0.000029	1.010679	0.000062	284.2	284.2	296.0	293.7	1.02	11918.	N/A	N/A
0.000006	0.000067	1.010679	0.000062	284.2	284.1	296.1	293.7	0.89	11974.	N/A	N/A
-0.000007	0.000054	1.010679	0.000062	284.2	284.2	296.1	293.7	0.76	12030.	N/A	N/A
-0.000025	0.000036	1.010679	0.000062	284.2	284.1	296.1	293.7	0.64	12091.	N/A	N/A
0.000000	0.000061	1.010679	0.000062	284.2	284.1	296.1	293.7	0.51	12143.	N/A	N/A
-0.000012	0.000050	1.010679	0.000062	284.2	284.1	296.1	293.7	0.38	12197.	N/A	N/A
-0.000037	0.000024	1.010679	0.000062	284.2	284.1	296.1	293.7	0.25	12250.	N/A	N/A
-0.000042	0.000019	1.010679	0.000062	284.2	284.1	296.1	293.7	0.13	12305.	N/A	N/A
-0.000055	0.000002	1.003075	0.000057	283.7	283.6	295.6	293.7	1.59	15484.	N/A	N/A
-0.000104	-0.000047	1.003075	0.000057	283.7	283.7	295.8	293.7	1.52	15541.	N/A	N/A
-0.000149	-0.000091	1.003075	0.000057	283.7	283.7	295.7	293.7	1.40	15599.	N/A	N/A
-0.000141	-0.000084	1.003075	0.000057	283.7	283.6	295.7	293.7	1.27	15652.	N/A	N/A
-0.000123	-0.000066	1.003075	0.000057	283.7	283.7	295.4	293.7	1.14	15722.	N/A	N/A
-0.000129	-0.000072	1.003075	0.000057	283.7	283.7	295.5	293.7	1.02	15778.	N/A	N/A
-0.000098	-0.000041	1.003075	0.000057	283.7	283.7	295.7	293.7	0.89	15835.	N/A	N/A
-0.000129	-0.000072	1.003075	0.000057	283.8	283.7	295.8	293.7	0.76	15890.	N/A	N/A
-0.000126	-0.000069	1.003075	0.000057	283.7	283.7	295.3	293.7	0.64	15953.	N/A	N/A
-0.000152	-0.000094	1.003075	0.000057	283.7	283.6	295.2	293.7	0.51	16008.	N/A	N/A
-0.000127	-0.000070	1.003075	0.000057	283.7	283.6	295.7	293.7	0.38	16065.	N/A	N/A
-0.000187	-0.000129	1.003075	0.000057	283.7	283.7	295.4	293.7	0.25	16120.	N/A	N/A
-0.000173	-0.000115	1.003075	0.000057	283.7	283.6	295.4	293.7	0.13	16191.	N/A	N/A
-0.000298	-0.000403	1.005909	-0.000108	285.3	285.3	294.0	293.7	1.59	77260.	N/A	N/A
-0.000334	-0.000438	1.005909	-0.000108	285.3	285.3	294.0	293.7	1.52	77315.	N/A	N/A
-0.000319	-0.000423	1.005909	-0.000108	285.3	285.3	294.2	293.7	1.40	77369.	N/A	N/A
-0.000357	-0.000461	1.005909	-0.000108	285.3	285.3	294.1	293.7	1.27	77421.	N/A	N/A
-0.000316	-0.000421	1.005909	-0.000108	285.3	285.3	294.0	293.7	1.14	77475.	N/A	N/A
-0.000364	-0.000468	1.005909	-0.000108	285.3	285.3	293.9	293.7	1.02	77526.	N/A	N/A
-0.000340	-0.000444	1.005909	-0.000108	285.3	285.3	294.0	293.7	0.89	77580.	N/A	N/A
-0.000316	-0.000420	1.005909	-0.000108	285.3	285.3	294.0	293.7	0.76	77632.	N/A	N/A
-0.000324	-0.000429	1.005909	-0.000108	285.3	285.3	294.1	293.7	0.64	77682.	N/A	N/A
-0.000313	-0.000417	1.005909	-0.000108	285.3	285.3	293.9	293.7	0.51	77735.	N/A	N/A
-0.000346	-0.000450	1.005909	-0.000108	285.3	285.3	294.0	293.7	0.38	77789.	N/A	N/A
-0.000366	-0.000470	1.005909	-0.000108	285.3	285.3	294.0	293.7	0.25	77841.	N/A	N/A
-0.000355	-0.000458	1.005909	-0.000108	285.3	285.3	293.9	293.7	0.13	77895.	N/A	N/A
-0.000385	-0.000396	1.004326	-0.000015	285.3	285.3	294.0	293.7	1.59	78063.	N/A	N/A
-0.000418	-0.000429	1.004326	-0.000015	285.3	285.3	294.0	293.7	1.52	78114.	N/A	N/A
-0.000463	-0.000474	1.004326	-0.000015	285.3	285.2	293.9	293.7	1.40	78168.	N/A	N/A
-0.000453	-0.000463	1.004326	-0.000015	285.3	285.2	294.0	293.7	1.27	78219.	N/A	N/A
-0.000406	-0.000417	1.004326	-0.000015	285.2	285.2	293.9	293.7	1.14	78274.	N/A	N/A

Table H.2.1 Diesel contamination on oxidized copper surface for Re = 0 and x_b = 0.2 % (file:trv0con1.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
2.15	183.	-0.002	792.	0.	294.4	-0.8	1.00
2.15	183.	-0.002	842.	0.	294.4	-0.8	1.00
2.15	183.	-0.002	894.	0.	294.4	-0.9	1.00
2.15	183.	-0.002	945.	0.	294.5	-0.9	1.00
2.15	183.	-0.002	995.	0.	294.5	-1.0	1.00
2.15	183.	-0.002	1052.	0.	294.6	-1.0	1.00
2.15	183.	-0.002	1104.	0.	294.6	-1.0	1.00
2.15	183.	-0.002	1156.	0.	294.6	-1.1	1.00
2.15	183.	-0.002	1216.	0.	294.7	-1.1	1.00
2.15	183.	-0.002	1268.	0.	294.7	-1.1	1.00
2.15	183.	-0.002	1322.	0.	294.7	-1.2	1.00
2.15	183.	-0.002	1377.	0.	294.8	-1.2	1.00
2.15	183.	-0.002	1429.	0.	294.8	-1.2	1.00
2.62	222.	0.024	1620.	0.	294.9	-1.3	1.00
2.62	222.	0.024	1672.	0.	294.9	-1.4	1.00
2.62	222.	0.024	1726.	0.	294.9	-1.4	1.00
2.62	222.	0.024	1786.	0.	295.0	-1.4	1.00
2.62	222.	0.024	1838.	0.	295.0	-1.4	1.00
2.62	222.	0.024	1895.	0.	295.0	-1.5	1.00
2.62	222.	0.024	1948.	0.	295.0	-1.5	1.00
2.62	222.	0.024	2017.	0.	295.1	-1.5	1.00
2.62	222.	0.024	2072.	0.	295.1	-1.5	1.00
2.62	222.	0.024	2124.	0.	295.1	-1.5	1.00
2.62	222.	0.024	2177.	0.	295.1	-1.6	1.00
2.62	222.	0.024	2231.	0.	295.1	-1.6	1.00
2.62	222.	0.024	2283.	0.	295.2	-1.6	1.00
3.22	274.	-0.041	6047.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6098.	0.	295.7	-2.2	1.00
3.22	274.	-0.041	6150.	0.	295.7	-2.2	1.00
3.22	274.	-0.041	6206.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6259.	0.	295.7	-2.2	1.00
3.22	274.	-0.041	6312.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6367.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6420.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6471.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6522.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6575.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6628.	0.	295.8	-2.2	1.00
3.22	274.	-0.041	6686.	0.	295.8	-2.2	1.00
4.75	403.	0.042	9446.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9497.	0.	295.9	-2.3	1.00
4.75	403.	0.042	9553.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9603.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9655.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9707.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9764.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9818.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9872.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9924.	0.	295.9	-2.4	1.00
4.75	403.	0.042	9981.	0.	295.9	-2.4	1.00
4.75	403.	0.042	10034.	0.	295.9	-2.4	1.00
4.75	403.	0.042	10087.	0.	295.9	-2.4	1.00
4.97	422.	0.059	10243.	0.	295.9	-2.4	1.00
4.97	422.	0.059	10300.	0.	295.9	-2.4	1.00
4.97	422.	0.059	10355.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10409.	0.	295.9	-2.4	1.00
4.97	422.	0.059	10463.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10518.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10574.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10625.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10682.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10734.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10842.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10893.	0.	296.0	-2.4	1.00
4.97	422.	0.059	10945.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11099.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11153.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11209.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11263.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11319.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11378.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11430.	0.	296.0	-2.5	1.00
5.25	445.	0.045	11484.	0.	296.0	-2.5	1.00
5.25	445.	0.045	11540.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11596.	0.	296.0	-2.5	1.00
5.25	445.	0.045	11648.	0.	296.0	-2.4	1.00
5.25	445.	0.045	11704.	0.	296.0	-2.5	1.00
5.25	445.	0.045	11763.	0.	296.0	-2.5	1.00
1.34	113.	0.363	78324.	0.	295.7	-2.2	1.00
1.34	113.	0.363	78374.	0.	295.8	-2.2	1.00
1.34	113.	0.363	78427.	0.	295.7	-2.2	1.00
1.34	113.	0.363	78479.	0.	295.7	-2.2	1.00
1.34	113.	0.363	78531.	0.	295.8	-2.2	1.00
1.34	113.	0.363	78588.	0.	295.7	-2.2	1.00
1.34	113.	0.363	78641.	0.	295.8	-2.2	1.00
1.34	113.	0.363	78695.	0.	295.7	-2.2	1.00
1.34	113.	0.363	78748.	0.	295.8	-2.2	1.00
1.34	113.	0.363	78800.	0.	295.8	-2.2	1.00
1.34	113.	0.363	78853.	0.	295.7	-2.2	1.00
1.34	113.	0.363	78906.	0.	295.8	-2.2	1.00
1.34	113.	0.363	78959.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82641.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82691.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82741.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82795.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82850.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82904.	0.	295.8	-2.2	1.00
0.79	67.	0.316	82961.	0.	295.8	-2.2	1.00
0.79	67.	0.316	83012.	0.	295.8	-2.2	1.00
0.79	67.	0.316	83068.	0.	295.8	-2.2	1.00
0.79	67.	0.316	83125.	0.	295.8	-2.2	1.00
0.79	67.	0.316	83193.	0.	295.8	-2.2	1.00
0.79	67.	0.316	83247.	0.	295.8	-2.2	1.00
0.79	67.	0.316	83307.	0.	295.8	-2.2	1.00
0.90	76.	0.299	86829.	0.	295.8	-2.2	1.00
0.90	76.	0.299	86883.	0.	295.7	-2.2	1.00
0.90	76.	0.299	86940.	0.	295.7	-2.2	1.00
0.90	76.	0.299	86991.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87042.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87094.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87146.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87199.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87252.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87308.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87361.	0.	295.8	-2.2	1.00
0.90	76.	0.299	87411.	0.	295.7	-2.2	1.00
0.90	76.	0.299	87465.	0.	295.7	-2.2	1.00
1.38	117.	0.281	87638.	0.	295.8	-2.2	1.00
1.38	117.	0.281	87693.	0.	295.8	-2.2	1.00
1.38	117.	0.281	87760.	0.	295.8	-2.2	1.00
1.38	117.	0.281	87817.	0.	295.8	-2.2	1.00
1.38	117.	0.281	87869.	0.	295.8	-2.2	1.00
1.38	117.	0.281	87921.	0.	295.8	-2.2	1.00
1.38	117.	0.281	87975.	0.	295.8	-2.2	1.00
1.38	117.	0.281	88028.	0.	295.8	-2.2	1.00
1.38	117.	0.281	88084.	0.	295.8	-2.2	1.00
1.38	117.	0.281	88139.	0.	295.8	-2.2	1.00
1.38	117.	0.281	88195.	0.	295.8	-2.2	1.00
1.38	117.	0.281	88247.	0.	295.8	-2.2	1.00
1.38	117.	0.281	88303.	0.	295.8	-2.2	1.00
1.27	108.	0.265	93296.	0.	295.9	-2.3	1.00
1.27	108.	0.265	93361.	0.	295.9	-2.3	1.00

Table H.2.2 Diesel contamination on oxidized copper surface for Re = 1900 and x_b = 0.2 % (file:trv15con1.tb2)

l_e (µm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
0.20	17.	0.285	1008.	1643.	295.5	-1.8	1.00
0.20	17.	0.285	1065.	1587.	295.5	-1.8	1.00
0.20	17.	0.285	1135.	1633.	295.4	-1.8	1.00
0.20	17.	0.285	1179.	1597.	295.4	-1.8	1.00
0.20	17.	0.285	1258.	1613.	295.4	-1.8	1.00
0.20	17.	0.285	1321.	1623.	295.4	-1.7	1.00
0.20	17.	0.285	1392.	1529.	295.3	-1.7	1.00
0.20	17.	0.285	1492.	1571.	295.3	-1.7	1.00
0.20	17.	0.285	1536.	1591.	295.3	-1.6	1.00
0.20	17.	0.285	1574.	1597.	295.2	-1.6	1.00
0.20	17.	0.285	1617.	1521.	295.2	-1.6	1.00
0.20	17.	0.285	1661.	1542.	295.2	-1.6	1.00
0.20	17.	0.285	1705.	1599.	295.2	-1.5	1.00
0.27	23.	0.198	61523.	1739.	293.5	0.1	1.00
0.27	23.	0.198	61568.	1800.	293.5	0.1	1.00
0.27	23.	0.198	61614.	1778.	293.5	0.2	1.00
0.27	23.	0.198	61656.	1787.	293.4	0.2	1.00
0.27	23.	0.198	61697.	1788.	293.4	0.2	1.00
0.27	23.	0.198	61743.	1802.	293.4	0.2	1.00
0.27	23.	0.198	61782.	1712.	293.4	0.2	1.00
0.27	23.	0.198	61823.	1778.	293.4	0.3	1.00
0.27	23.	0.198	61865.	1750.	293.4	0.3	1.00
0.27	23.	0.198	61905.	1697.	293.4	0.3	1.00
0.27	23.	0.198	61946.	1776.	293.3	0.3	1.00
0.27	23.	0.198	61987.	1759.	293.3	0.3	1.00
0.27	23.	0.198	62026.	1794.	293.3	0.3	1.00
0.65	55.	0.179	62198.	1706.	293.3	0.4	1.00
0.65	55.	0.179	62241.	1737.	293.3	0.4	1.00
0.65	55.	0.179	62282.	1781.	293.2	0.4	1.00
0.65	55.	0.179	62324.	1746.	293.2	0.4	1.00
0.65	55.	0.179	62367.	1705.	293.2	0.4	1.00
0.65	55.	0.179	62409.	1785.	293.2	0.4	1.00
0.65	55.	0.179	62454.	1743.	293.2	0.4	1.00
0.65	55.	0.179	62498.	1756.	293.2	0.4	1.00
0.65	55.	0.179	62539.	1696.	293.2	0.4	1.00
0.65	55.	0.179	62581.	1763.	293.2	0.4	1.00
0.65	55.	0.179	62622.	1765.	293.2	0.4	1.00
0.65	55.	0.179	62664.	1776.	293.2	0.4	1.00
0.65	55.	0.179	62707.	1725.	293.2	0.4	1.00
1.68	143.	0.152	66387.	1801.	293.7	0.0	1.00
1.68	143.	0.152	66427.	1783.	293.7	0.0	1.00
1.68	143.	0.152	66469.	1746.	293.6	0.0	1.00
1.68	143.	0.152	66509.	1824.	293.6	0.0	1.00
1.68	143.	0.152	66551.	1810.	293.6	0.1	1.00
1.68	143.	0.152	66592.	1810.	293.6	0.1	1.00
1.68	143.	0.152	66632.	1784.	293.5	0.1	1.00
1.68	143.	0.152	66709.	1682.	293.5	0.1	1.00
1.68	143.	0.152	66749.	1722.	293.5	0.1	1.00
1.68	143.	0.152	66788.	1779.	293.5	0.2	1.00
1.68	143.	0.152	66829.	1706.	293.4	0.2	1.00
1.68	143.	0.152	66869.	1794.	293.4	0.2	1.00
1.68	143.	0.152	66910.	1748.	293.4	0.2	1.00
0.43	36.	0.250	69847.	1776.	294.0	-0.3	1.00
0.43	36.	0.250	69884.	1736.	294.0	-0.3	1.00
0.43	36.	0.250	69926.	1785.	294.0	-0.3	1.00
0.43	36.	0.250	69967.	1789.	294.0	-0.3	1.00
0.43	36.	0.250	70009.	1795.	294.0	-0.4	1.00
0.43	36.	0.250	70049.	1714.	294.0	-0.3	1.00
0.43	36.	0.250	70091.	1827.	294.0	-0.3	1.00
0.43	36.	0.250	70131.	1768.	294.0	-0.4	1.00
0.43	36.	0.250	70173.	1799.	294.0	-0.3	1.00
0.43	36.	0.250	70212.	1727.	294.0	-0.3	1.00
0.43	36.	0.250	70255.	1754.	294.0	-0.3	1.00
0.43	36.	0.250	70295.	1770.	294.0	-0.3	1.00
0.43	36.	0.250	70333.	1774.	294.0	-0.3	1.00
0.24	21.	0.207	70481.	1785.	294.0	-0.3	1.00
0.24	21.	0.207	70523.	1783.	294.0	-0.3	1.00
0.24	21.	0.207	70562.	1749.	293.9	-0.3	1.00
0.24	21.	0.207	70603.	1732.	293.9	-0.3	1.00
0.24	21.	0.207	70645.	1792.	293.9	-0.3	1.00
0.24	21.	0.207	70685.	1825.	293.9	-0.3	1.00
0.24	21.	0.207	70726.	1843.	293.9	-0.3	1.00
0.24	21.	0.207	70767.	1785.	293.9	-0.3	1.00
0.24	21.	0.207	70807.	1772.	293.9	-0.2	1.00
0.24	21.	0.207	70846.	1707.	293.9	-0.2	1.00
0.24	21.	0.207	70886.	1728.	293.8	-0.2	1.00
0.24	21.	0.207	70928.	1706.	293.9	-0.2	1.00
0.24	21.	0.207	70968.	1734.	293.8	-0.2	1.00
0.06	5.	0.202	71125.	1826.	293.8	-0.1	1.00
0.06	5.	0.202	71164.	1779.	293.7	-0.1	1.00
0.06	5.	0.202	71204.	1803.	293.7	-0.1	1.00
0.06	5.	0.202	71251.	1747.	293.7	-0.1	1.00
0.06	5.	0.202	71295.	1755.	293.7	-0.1	1.00
0.06	5.	0.202	71336.	1754.	293.6	0.0	1.00
0.06	5.	0.202	71379.	1723.	293.6	0.0	1.00
0.06	5.	0.202	71420.	1732.	293.6	0.0	1.00
0.06	5.	0.202	71461.	1746.	293.6	0.0	1.00
0.06	5.	0.202	71503.	1797.	293.6	0.1	1.00
0.06	5.	0.202	71543.	1784.	293.6	0.1	1.00
0.06	5.	0.202	71583.	1778.	293.5	0.1	1.00
0.06	5.	0.202	71624.	1806.	293.5	0.1	1.00
-0.09	-8.	0.204	80588.	1803.	293.9	-0.3	1.00
-0.09	-8.	0.204	80631.	1813.	293.9	-0.3	1.00
-0.09	-8.	0.204	80674.	1820.	293.9	-0.3	1.00
-0.09	-8.	0.204	80717.	1743.	293.9	-0.3	1.00
-0.09	-8.	0.204	80759.	1819.	293.9	-0.2	1.00
-0.09	-8.	0.204	80803.	1783.	293.9	-0.2	1.00
-0.09	-8.	0.204	80848.	1784.	293.8	-0.2	1.00
-0.09	-8.	0.204	80892.	1723.	293.8	-0.2	1.00
-0.09	-8.	0.204	80933.	1845.	293.8	-0.2	1.00
-0.09	-8.	0.204	80977.	1749.	293.8	-0.1	1.00
-0.09	-8.	0.204	81018.	1707.	293.8	-0.1	1.00
-0.09	-8.	0.204	81061.	1803.	293.7	-0.1	1.00
-0.09	-8.	0.204	81106.	1755.	293.7	-0.1	1.00
-0.12	-10.	0.201	84789.	1751.	294.0	-0.3	1.00
-0.12	-10.	0.201	84836.	1730.	294.0	-0.3	1.00
-0.12	-10.	0.201	84888.	1726.	294.0	-0.3	1.00
-0.12	-10.	0.201	84954.	1805.	294.0	-0.3	1.00
-0.12	-10.	0.201	85002.	1797.	294.0	-0.3	1.00
-0.12	-10.	0.201	85046.	1695.	294.0	-0.3	1.00
-0.12	-10.	0.201	85085.	1726.	294.0	-0.3	1.00
-0.12	-10.	0.201	85122.	1713.	294.0	-0.3	1.00
-0.12	-10.	0.201	85173.	1834.	294.0	-0.3	1.00
-0.12	-10.	0.201	85210.	1821.	294.0	-0.3	1.00
-0.12	-10.	0.201	85250.	1825.	294.0	-0.3	1.00
-0.12	-10.	0.201	85289.	1823.	293.9	-0.3	1.00
-0.12	-10.	0.201	85357.	1820.	293.9	-0.3	1.00
-0.09	-8.	0.187	150554.	1704.	293.9	-0.3	1.00
-0.09	-8.	0.187	150599.	1729.	293.9	-0.3	1.00
-0.09	-8.	0.187	150645.	1782.	293.9	-0.3	1.00
-0.09	-8.	0.187	150688.	1831.	293.9	-0.2	1.00
-0.09	-8.	0.187	150735.	1716.	293.8	-0.2	1.00
-0.09	-8.	0.187	150775.	1792.	293.8	-0.2	1.00
-0.09	-8.	0.187	150817.	1743.	293.8	-0.2	1.00
-0.09	-8.	0.187	150855.	1796.	293.8	-0.2	1.00
-0.09	-8.	0.187	150898.	1764.	293.8	-0.1	1.00
-0.09	-8.	0.187	150937.	1733.	293.8	-0.1	1.00
-0.09	-8.	0.187	150978.	1721.	293.7	-0.1	1.00
-0.09	-8.	0.187	151018.	1766.	293.7	-0.1	1.00
-0.09	-8.	0.187	151060.	1780.	293.7	-0.1	1.00
-0.15	-13.	0.191	151192.	1726.	293.6	0.0	1.00
-0.15	-13.	0.191	151234.	1711.	293.6	0.0	1.00
-0.15	-13.	0.191	151277.	1800.	293.6	0.0	1.00
-0.15	-13.	0.191	151319.	1796.	293.6	0.0	1.00
-0.15	-13.	0.191	151364.	1786.	293.6	0.1	1.00
-0.15	-13.	0.191	151406.	1767.	293.6	0.1	1.00
-0.15	-13.	0.191	151448.	1784.	293.5	0.1	1.00
-0.15	-13.	0.191	151489.	1795.	293.5	0.1	1.00
-0.15	-13.	0.191	151529.	1815.	293.5	0.1	1.00
-0.15	-13.	0.191	151569.	1691.	293.4	0.2	1.00
-0.15	-13.	0.191	151609.	1727.	293.4	0.2	1.00
-0.15	-13.	0.191	151650.	1716.	293.4	0.2	1.00
-0.15	-13.	0.191	151691.	1723.	293.4	0.2	1.00
-0.17	-14.	0.194	154873.	1797.	294.0	-0.3	1.00
-0.17	-14.	0.194	154913.	1770.	294.0	-0.3	1.00
-0.17	-14.	0.194	154958.	1774.	294.0	-0.3	1.00
-0.17	-14.	0.194	155004.	1739.	294.0	-0.3	1.00
-0.17	-14.	0.194	155046.	1791.	294.0	-0.3	1.00
-0.17	-14.	0.194	155087.	1816.	294.0	-0.3	1.00
-0.17	-14.	0.194	155128.	1847.	294.0	-0.3	1.00
-0.17	-14.	0.194	155168.	1811.	294.0	-0.3	1.00
-0.17	-14.	0.194	155208.	1811.	294.0	-0.3	1.00
-0.17	-14.	0.194	155248.	1718.	294.0	-0.3	1.00
-0.17	-14.	0.194	155292.	1815.	294.0	-0.3	1.00
-0.17	-14.	0.194	155333.	1753.	294.0	-0.3	1.00
-0.17	-14.	0.194	155377.	1738.	294.0	-0.3	1.00
-0.23	-20.	0.194	158222.	1712.	293.3	0.3	1.00
-0.23	-20.	0.194	158266.	1780.	293.3	0.3	1.00
-0.23	-20.	0.194	158309.	1721.	293.3	0.3	1.00

Table H.2.3 Diesel contamination on oxidized copper surface for Re = 3200 and x_b = 0.2 % (file:trv3con1.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
-0.36	-30.	0.309	1521.	3405.	296.1	-2.5	1.00
-0.36	-30.	0.309	1563.	3305.	296.2	-2.5	1.00
-0.36	-30.	0.309	1607.	3389.	296.2	-2.5	1.00
-0.36	-30.	0.309	1706.	3349.	296.2	-2.5	1.00
-0.36	-30.	0.309	1749.	3300.	296.2	-2.5	1.00
-0.36	-30.	0.309	1789.	3228.	296.2	-2.5	1.00
-0.36	-30.	0.309	1831.	3390.	296.2	-2.5	1.00
-0.36	-30.	0.309	1873.	3178.	296.2	-2.5	1.00
-0.36	-30.	0.309	1920.	3405.	296.2	-2.5	1.00
-0.36	-30.	0.309	1966.	3357.	296.2	-2.5	1.00
-0.36	-30.	0.309	2009.	3390.	296.2	-2.5	1.00
-0.36	-30.	0.309	2051.	3372.	296.2	-2.5	1.00
-0.36	-30.	0.309	2092.	3283.	296.2	-2.5	1.00
-0.47	-40.	0.296	2224.	3216.	296.2	-2.5	1.00
-0.47	-40.	0.296	2267.	3301.	296.2	-2.5	1.00
-0.47	-40.	0.296	2310.	3389.	296.2	-2.5	1.00
-0.47	-40.	0.296	2354.	3356.	296.2	-2.5	1.00
-0.47	-40.	0.296	2401.	3234.	296.1	-2.5	1.00
-0.47	-40.	0.296	2442.	3273.	296.1	-2.5	1.00
-0.47	-40.	0.296	2482.	3378.	296.1	-2.5	1.00
-0.47	-40.	0.296	2524.	3327.	296.1	-2.5	1.00
-0.47	-40.	0.296	2569.	3310.	296.1	-2.5	1.00
-0.47	-40.	0.296	2775.	3244.	296.1	-2.4	1.00
-0.47	-40.	0.296	2819.	3241.	296.0	-2.4	1.00
-0.47	-40.	0.296	2862.	3337.	296.0	-2.4	1.00
-0.47	-40.	0.296	2903.	3194.	296.0	-2.4	1.00
-0.47	-40.	0.268	5441.	3245.	294.4	-0.8	1.00
-0.47	-40.	0.268	5486.	3227.	294.4	-0.8	1.00
-0.47	-40.	0.268	5531.	3253.	294.4	-0.7	1.00
-0.47	-40.	0.268	5572.	3276.	294.3	-0.7	1.00
-0.47	-40.	0.268	5619.	3164.	294.3	-0.6	1.00
-0.47	-40.	0.268	5660.	3209.	294.3	-0.6	1.00
-0.47	-40.	0.268	5702.	3113.	294.2	-0.6	1.00
-0.47	-40.	0.268	5744.	3195.	294.2	-0.6	1.00
-0.47	-40.	0.268	5783.	3110.	294.2	-0.5	1.00
-0.47	-40.	0.268	5824.	3083.	294.1	-0.5	1.00
-0.47	-40.	0.268	5866.	3242.	294.1	-0.4	1.00
-0.47	-40.	0.268	5909.	3209.	294.1	-0.4	1.00
-0.47	-40.	0.268	5957.	3083.	294.0	-0.4	1.00
-0.32	-27.	0.256	8736.	3192.	293.2	0.5	1.00
-0.32	-27.	0.256	8776.	3194.	293.2	0.5	1.00
-0.32	-27.	0.256	8821.	3211.	293.2	0.4	1.00
-0.32	-27.	0.256	8865.	3118.	293.2	0.4	1.00
-0.32	-27.	0.256	8906.	3075.	293.3	0.4	1.00
-0.32	-27.	0.256	8946.	3168.	293.3	0.4	1.00
-0.32	-27.	0.256	8988.	3098.	293.3	0.3	1.00
-0.32	-27.	0.256	9028.	3117.	293.3	0.3	1.00
-0.32	-27.	0.256	9070.	3132.	293.3	0.3	1.00
-0.32	-27.	0.256	9116.	3236.	293.3	0.3	1.00
-0.32	-27.	0.256	9162.	3173.	293.4	0.3	1.00
-0.32	-27.	0.256	9204.	3083.	293.4	0.3	1.00
-0.32	-27.	0.256	9244.	3093.	293.4	0.2	1.00
-0.28	-24.	0.246	9383.	3208.	293.5	0.2	1.00
-0.28	-24.	0.246	9424.	3107.	293.5	0.2	1.00
-0.28	-24.	0.246	9465.	3177.	293.5	0.1	1.00
-0.28	-24.	0.246	9506.	3178.	293.5	0.1	1.00
-0.28	-24.	0.246	9548.	3219.	293.6	0.1	1.00
-0.28	-24.	0.246	9592.	3213.	293.6	0.1	1.00
-0.28	-24.	0.246	9635.	3084.	293.6	0.0	1.00
-0.28	-24.	0.246	9677.	3266.	293.6	0.0	1.00
-0.28	-24.	0.246	9721.	3196.	293.6	0.0	1.00
-0.28	-24.	0.246	9765.	3172.	293.7	0.0	1.00
-0.28	-24.	0.246	9807.	3121.	293.7	-0.1	1.00
-0.28	-24.	0.246	9849.	3154.	293.7	-0.1	1.00
-0.28	-24.	0.246	9892.	3171.	293.7	-0.1	1.00
-0.38	-32.	0.240	10046.	3258.	293.8	-0.2	1.00
-0.38	-32.	0.240	10087.	3141.	293.9	-0.2	1.00
-0.38	-32.	0.240	10132.	3151.	293.9	-0.2	1.00
-0.38	-32.	0.240	10175.	3216.	293.9	-0.3	1.00
-0.38	-32.	0.240	10219.	3071.	293.9	-0.3	1.00
-0.38	-32.	0.240	10261.	3186.	293.9	-0.3	1.00
-0.38	-32.	0.240	10304.	3088.	294.0	-0.3	1.00
-0.38	-32.	0.240	10347.	3172.	294.0	-0.3	1.00
-0.38	-32.	0.240	10389.	3126.	294.0	-0.3	1.00
-0.38	-32.	0.240	10431.	3222.	294.0	-0.4	1.00
-0.38	-32.	0.240	10471.	3143.	294.0	-0.4	1.00
-0.38	-32.	0.240	10514.	3143.	294.0	-0.4	1.00
-0.38	-32.	0.240	10556.	3279.	294.0	-0.4	1.00
-0.55	-46.	0.271	13307.	3069.	293.3	0.4	1.00
-0.55	-46.	0.271	13350.	3054.	293.3	0.4	1.00
-0.55	-46.	0.271	13403.	3191.	293.3	0.4	1.00
-0.55	-46.	0.271	13445.	3197.	293.3	0.4	1.00
-0.55	-46.	0.271	13492.	3128.	293.3	0.4	1.00
-0.55	-46.	0.271	13541.	3119.	293.3	0.4	1.00
-0.55	-46.	0.271	13582.	3097.	293.3	0.4	1.00
-0.55	-46.	0.271	13624.	3145.	293.3	0.4	1.00
-0.55	-46.	0.271	13665.	3128.	293.3	0.4	1.00
-0.55	-46.	0.271	13709.	3106.	293.3	0.4	1.00
-0.55	-46.	0.271	13750.	3264.	293.3	0.4	1.00
-0.55	-46.	0.271	13807.	3099.	293.3	0.3	1.00
-0.55	-46.	0.271	13848.	3183.	293.3	0.4	1.00
-0.19	-17.	0.214	16251.	3229.	294.0	-0.3	1.00
-0.19	-17.	0.214	16296.	3229.	294.0	-0.3	1.00
-0.19	-17.	0.214	16340.	3229.	294.0	-0.3	1.00
-0.19	-17.	0.214	16380.	3233.	293.9	-0.3	1.00
-0.19	-17.	0.214	16428.	3104.	293.9	-0.3	1.00
-0.19	-17.	0.214	16471.	3209.	293.9	-0.3	1.00
-0.19	-17.	0.214	16518.	3100.	293.9	-0.2	1.00
-0.19	-17.	0.214	16559.	3216.	293.9	-0.3	1.00
-0.19	-17.	0.214	16607.	3254.	293.9	-0.2	1.00
-0.19	-17.	0.214	16650.	3041.	293.9	-0.2	1.00
-0.19	-17.	0.214	16693.	3227.	293.9	-0.2	1.00
-0.19	-17.	0.214	16735.	3097.	293.8	-0.2	1.00
-0.19	-17.	0.214	16777.	3266.	293.8	-0.2	1.00
-0.19	-16.	0.227	21142.	3150.	294.0	-0.3	1.00
-0.19	-16.	0.227	21186.	3158.	294.0	-0.3	1.00
-0.19	-16.	0.227	21233.	3203.	293.9	-0.3	1.00
-0.19	-16.	0.227	21277.	3187.	293.9	-0.3	1.00
-0.19	-16.	0.227	21322.	3074.	293.9	-0.3	1.00
-0.19	-16.	0.227	21366.	3155.	293.9	-0.3	1.00
-0.19	-16.	0.227	21413.	3264.	293.9	-0.3	1.00
-0.19	-16.	0.227	21458.	3205.	293.9	-0.2	1.00
-0.19	-16.	0.227	21504.	3278.	293.9	-0.2	1.00
-0.19	-16.	0.227	21548.	3142.	293.9	-0.2	1.00
-0.19	-16.	0.227	21591.	3180.	293.8	-0.2	1.00
-0.19	-16.	0.227	21640.	3140.	293.8	-0.2	1.00
-0.19	-16.	0.227	21684.	3209.	293.8	-0.2	1.00
0.21	18.	0.203	21839.	3237.	293.8	-0.1	1.00
0.21	18.	0.203	21883.	3141.	293.7	-0.1	1.00
0.21	18.	0.203	21928.	3211.	293.7	-0.1	1.00
0.21	18.	0.203	21971.	3273.	293.7	0.0	1.00
0.21	18.	0.203	22017.	3183.	293.7	0.0	1.00
0.21	18.	0.203	22063.	3229.	293.6	0.0	1.00
0.21	18.	0.203	22112.	3112.	293.6	0.0	1.00
0.21	18.	0.203	22163.	3241.	293.6	0.1	1.00
0.21	18.	0.203	22211.	3206.	293.6	0.1	1.00
0.21	18.	0.203	22255.	3093.	293.6	0.1	1.00
0.21	18.	0.203	22299.	3228.	293.5	0.1	1.00
0.21	18.	0.203	22343.	3139.	293.5	0.2	1.00
0.21	18.	0.203	22385.	3133.	293.5	0.1	1.00
0.15	13.	0.220	26466.	3174.	293.9	-0.2	1.00
0.15	13.	0.220	26517.	3158.	293.9	-0.2	1.00
0.15	13.	0.220	26566.	3138.	293.8	-0.1	1.00
0.15	13.	0.220	26615.	3256.	293.8	-0.1	1.00
0.15	13.	0.220	26661.	3280.	293.8	-0.1	1.00
0.15	13.	0.220	26702.	3254.	293.8	-0.1	1.00
0.15	13.	0.220	26748.	3134.	293.7	-0.1	1.00
0.15	13.	0.220	26794.	3140.	293.7	-0.1	1.00
0.15	13.	0.220	26841.	3131.	293.7	0.0	1.00
0.15	13.	0.220	26887.	3145.	293.7	0.0	1.00
0.15	13.	0.220	26934.	3197.	293.6	0.0	1.00
0.15	13.	0.220	26978.	3179.	293.6	0.0	1.00
0.15	13.	0.220	27023.	3118.	293.6	0.0	1.00
1.79	152.	0.283	349347.	3146.	293.9	-0.3	1.00
1.79	152.	0.283	349389.	3169.	293.9	-0.3	1.00
1.79	152.	0.283	349434.	3162.	294.0	-0.3	1.00
1.79	152.	0.283	349478.	3341.	294.0	-0.3	1.00
1.79	152.	0.283	349522.	3292.	294.0	-0.3	1.00
1.79	152.	0.283	349569.	3260.	294.0	-0.3	1.00
1.79	152.	0.283	349620.	3236.	294.0	-0.3	1.00
1.79	152.	0.283	349662.	3318.	294.0	-0.3	1.00
1.79	152.	0.283	349706.	3285.	294.0	-0.3	1.00
1.79	152.	0.283	349750.	3293.	294.0	-0.3	1.00
1.79	152.	0.283	349792.	3310.	294.0	-0.3	1.00
1.79	152.	0.283	349836.	3336.	294.0	-0.3	1.00

Table H.2.4 Diesel contamination on oxidized copper surface for Re = 4600 and x_b = 0.2 % (file:trv45con1.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\overline{T}_{T_\tau}$ (K)	$T_b-\overline{T}_{T_\tau}$ (K)	$\frac{F_{T_b}}{F_{T_\tau}}$
7.96	676.	0.171	236041.	4684.	293.4	0.3	1.00
7.96	676.	0.171	236081.	4736.	293.4	0.3	1.00
7.96	676.	0.171	236122.	4503.	293.4	0.3	1.00
7.96	676.	0.171	236166.	4684.	293.4	0.3	1.00
7.96	676.	0.171	236207.	4651.	293.4	0.3	1.00
7.96	676.	0.171	236249.	4601.	293.4	0.3	1.00
7.96	676.	0.171	236293.	4636.	293.4	0.3	1.00
7.96	676.	0.171	236338.	4459.	293.4	0.2	1.00
7.96	676.	0.171	236382.	4654.	293.4	0.2	1.00
7.96	676.	0.171	236423.	4524.	293.4	0.2	1.00
7.96	676.	0.171	236464.	4572.	293.4	0.2	1.00
7.96	676.	0.171	236505.	4480.	293.4	0.2	1.00
7.96	676.	0.171	236554.	4624.	293.4	0.2	1.00
7.89	670.	0.170	236711.	4568.	293.5	0.1	1.00
7.89	670.	0.170	236754.	4634.	293.5	0.1	1.00
7.89	670.	0.170	236797.	4571.	293.6	0.1	1.00
7.89	670.	0.170	236838.	4573.	293.6	0.1	1.00
7.89	670.	0.170	236883.	4593.	293.6	0.0	1.00
7.89	670.	0.170	236931.	4514.	293.6	0.0	1.00
7.89	670.	0.170	236982.	4500.	293.6	0.0	1.00
7.89	670.	0.170	237026.	4440.	293.7	0.0	1.00
7.89	670.	0.170	237070.	4736.	293.7	-0.1	1.00
7.89	670.	0.170	237111.	4477.	293.7	-0.1	1.00
7.89	670.	0.170	237152.	4465.	293.7	-0.1	1.00
7.89	670.	0.170	237198.	4628.	293.8	-0.1	1.00
7.89	670.	0.170	237241.	4800.	293.8	-0.1	1.00
7.83	665.	0.155	240174.	4594.	293.4	0.2	1.00
7.83	665.	0.155	240224.	4495.	293.4	0.2	1.00
7.83	665.	0.155	240267.	4491.	293.4	0.2	1.00
7.83	665.	0.155	240313.	4523.	293.4	0.3	1.00
7.83	665.	0.155	240355.	4505.	293.4	0.3	1.00
7.83	665.	0.155	240396.	4491.	293.4	0.3	1.00
7.83	665.	0.155	240460.	4650.	293.4	0.3	1.00
7.83	665.	0.155	240502.	4652.	293.4	0.3	1.00
7.83	665.	0.155	240546.	4504.	293.4	0.3	1.00
7.83	665.	0.155	240591.	4633.	293.4	0.3	1.00
7.83	665.	0.155	240635.	4460.	293.4	0.3	1.00
7.83	665.	0.155	240679.	4587.	293.4	0.3	1.00
7.83	665.	0.155	240723.	4429.	293.4	0.3	1.00
7.79	661.	0.150	243116.	4657.	294.0	-0.4	1.00
7.79	661.	0.150	243163.	4791.	294.0	-0.4	1.00
7.79	661.	0.150	243213.	4704.	294.0	-0.4	1.00
7.79	661.	0.150	243257.	4619.	294.0	-0.4	1.00
7.79	661.	0.150	243301.	4444.	294.0	-0.3	1.00
7.79	661.	0.150	243345.	4649.	294.0	-0.3	1.00
7.79	661.	0.150	243390.	4456.	294.0	-0.3	1.00
7.79	661.	0.150	243433.	4780.	293.9	-0.3	1.00
7.79	661.	0.150	243474.	4711.	293.9	-0.3	1.00
7.79	661.	0.150	243515.	4693.	293.9	-0.3	1.00
7.79	661.	0.150	243556.	4624.	293.9	-0.3	1.00
7.79	661.	0.150	243596.	4527.	293.9	-0.3	1.00
7.79	661.	0.150	243639.	4654.	293.9	-0.2	1.00
8.05	684.	0.121	243799.	4667.	293.8	-0.2	1.00
8.05	684.	0.121	243844.	4615.	293.8	-0.1	1.00
8.05	684.	0.121	243886.	4662.	293.8	-0.1	1.00
8.05	684.	0.121	243929.	4563.	293.8	-0.1	1.00
8.05	684.	0.121	243972.	4658.	293.7	-0.1	1.00
8.05	684.	0.121	244014.	4724.	293.7	-0.1	1.00
8.05	684.	0.121	244056.	4671.	293.7	-0.1	1.00
8.05	684.	0.121	244095.	4445.	293.7	0.0	1.00
8.05	684.	0.121	244138.	4583.	293.6	0.0	1.00
8.05	684.	0.121	244181.	4441.	293.6	0.0	1.00
8.05	684.	0.121	244226.	4547.	293.6	0.0	1.00
8.05	684.	0.121	244268.	4625.	293.6	0.1	1.00
8.05	684.	0.121	244315.	4496.	293.6	0.1	1.00
7.85	667.	0.152	244469.	4473.	293.5	0.1	1.00
7.85	667.	0.152	244510.	4548.	293.5	0.2	1.00
7.85	667.	0.152	244553.	4544.	293.5	0.2	1.00
7.85	667.	0.152	244598.	4624.	293.4	0.2	1.00
7.85	667.	0.152	244644.	4403.	293.4	0.2	1.00
7.85	667.	0.152	244685.	4671.	293.4	0.2	1.00
7.85	667.	0.152	244744.	4570.	293.4	0.2	1.00
7.85	667.	0.152	244791.	4636.	293.4	0.2	1.00
7.85	667.	0.152	244838.	4601.	293.4	0.3	1.00
7.85	667.	0.152	244885.	4617.	293.4	0.3	1.00
7.85	667.	0.152	244930.	4490.	293.4	0.3	1.00
7.85	667.	0.152	244975.	4649.	293.4	0.3	1.00
7.85	667.	0.152	245019.	4668.	293.4	0.3	1.00
7.84	666.	0.118	248265.	4789.	293.8	-0.2	1.00
7.84	666.	0.118	248305.	4685.	293.8	-0.1	1.00
7.84	666.	0.118	248349.	4648.	293.8	-0.1	1.00
7.84	666.	0.118	248392.	4632.	293.8	-0.1	1.00
7.84	666.	0.118	248436.	4626.	293.7	-0.1	1.00
7.84	666.	0.118	248482.	4743.	293.7	-0.1	1.00
7.84	666.	0.118	248524.	4707.	293.7	-0.1	1.00
7.84	666.	0.118	248566.	4555.	293.7	0.0	1.00
7.84	666.	0.118	248610.	4669.	293.7	0.0	1.00
7.84	666.	0.118	248650.	4632.	293.6	0.0	1.00
7.84	666.	0.118	248697.	4697.	293.6	0.0	1.00
7.84	666.	0.118	248739.	4680.	293.6	0.0	1.00
7.84	666.	0.118	248783.	4545.	293.6	0.1	1.00
7.50	637.	0.125	255063.	4646.	293.8	-0.1	1.00
7.50	637.	0.125	255106.	4458.	293.8	-0.1	1.00
7.50	637.	0.125	255151.	4635.	293.8	-0.2	1.00
7.50	637.	0.125	255199.	4707.	293.9	-0.2	1.00
7.50	637.	0.125	255243.	4743.	293.9	-0.2	1.00
7.50	637.	0.125	255284.	4676.	293.9	-0.3	1.00
7.50	637.	0.125	255327.	4598.	293.9	-0.3	1.00
7.50	637.	0.125	255369.	4698.	293.9	-0.3	1.00
7.50	637.	0.125	255413.	4719.	294.0	-0.3	1.00
7.50	637.	0.125	255457.	4705.	294.0	-0.3	1.00
7.50	637.	0.125	255502.	4687.	294.0	-0.4	1.00
7.50	637.	0.125	255544.	4607.	294.0	-0.4	1.00
7.50	637.	0.125	255586.	4640.	294.0	-0.4	1.00
7.40	628.	0.151	261040.	4483.	294.1	-0.4	1.00
7.40	628.	0.151	261080.	4743.	294.1	-0.4	1.00
7.40	628.	0.151	261120.	4496.	294.0	-0.4	1.00
7.40	628.	0.151	261162.	4740.	294.0	-0.4	1.00
7.40	628.	0.151	261204.	4705.	294.0	-0.4	1.00
7.40	628.	0.151	261245.	4462.	294.0	-0.4	1.00
7.40	628.	0.151	261287.	4618.	294.0	-0.3	1.00
7.40	628.	0.151	261331.	4584.	294.0	-0.3	1.00
7.40	628.	0.151	261373.	4666.	294.0	-0.3	1.00
7.40	628.	0.151	261412.	4766.	293.9	-0.3	1.00
7.40	628.	0.151	261453.	4712.	293.9	-0.3	1.00
7.40	628.	0.151	261494.	4694.	293.9	-0.3	1.00
7.40	628.	0.151	261535.	4544.	293.9	-0.3	1.00
7.51	637.	0.152	261665.	4638.	293.9	-0.2	1.00
7.51	637.	0.152	261705.	4572.	293.9	-0.2	1.00
7.51	637.	0.152	261748.	4704.	293.9	-0.2	1.00
7.51	637.	0.152	261789.	4504.	293.8	-0.2	1.00
7.51	637.	0.152	261828.	4633.	293.8	-0.2	1.00
7.51	637.	0.152	261871.	4632.	293.8	-0.1	1.00
7.51	637.	0.152	261914.	4498.	293.8	-0.1	1.00
7.51	637.	0.152	261955.	4727.	293.8	-0.1	1.00
7.51	637.	0.152	262001.	4404.	293.7	-0.1	1.00
7.51	637.	0.152	262045.	4557.	293.7	-0.1	1.00
7.51	637.	0.152	262087.	4414.	293.7	-0.1	1.00
7.51	637.	0.152	262129.	4460.	293.7	0.0	1.00
7.51	637.	0.152	262173.	4487.	293.6	0.0	1.00
7.34	623.	0.110	323906.	4531.	294.1	-0.4	1.00
7.34	623.	0.110	323949.	4467.	294.0	-0.4	1.00
7.34	623.	0.110	323995.	4674.	294.0	-0.4	1.00
7.34	623.	0.110	324038.	4707.	294.0	-0.4	1.00
7.34	623.	0.110	324081.	4623.	294.0	-0.4	1.00
7.34	623.	0.110	324121.	4479.	294.0	-0.4	1.00
7.34	623.	0.110	324163.	4687.	294.0	-0.4	1.00
7.34	623.	0.110	324202.	4508.	294.0	-0.3	1.00
7.34	623.	0.110	324244.	4476.	294.0	-0.3	1.00
7.34	623.	0.110	324285.	4489.	293.9	-0.3	1.00
7.34	623.	0.110	324327.	4681.	293.9	-0.3	1.00
7.34	623.	0.110	324368.	4411.	293.9	-0.3	1.00
7.34	623.	0.110	324412.	4578.	293.9	-0.3	1.00
7.08	601.	0.150	327196.	4693.	293.9	-0.3	1.00
7.08	601.	0.150	327249.	4612.	293.9	-0.3	1.00
7.08	601.	0.150	327299.	4731.	294.0	-0.3	1.00
7.08	601.	0.150	327353.	4444.	294.0	-0.3	1.00
7.08	601.	0.150	327404.	4652.	294.0	-0.4	1.00
7.08	601.	0.150	327448.	4724.	294.0	-0.4	1.00
7.08	601.	0.150	327492.	4724.	294.0	-0.4	1.00
7.08	601.	0.150	327535.	4673.	294.0	-0.4	1.00
7.08	601.	0.150	327577.	4437.	294.1	-0.4	1.00
7.08	601.	0.150	327620.	4529.	294.1	-0.4	1.00

Table H.2.5 Diesel contamination on oxidized copper surface for Re = 7000 and x_b = 0.2 % (file:trv6con1.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\overline{T}_{T_T}$ (K)	$T_b - \overline{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
0.08	7.	0.207	4639.	7434.	297.5	-3.8	0.99
0.08	7.	0.207	4684.	7364.	297.5	-3.8	0.99
0.08	7.	0.207	4728.	7259.	297.5	-3.9	0.99
0.08	7.	0.207	4771.	7155.	297.6	-3.9	0.99
0.08	7.	0.207	4813.	7463.	297.6	-4.0	0.99
0.08	7.	0.207	4857.	7199.	297.6	-4.0	0.99
0.08	7.	0.207	4900.	7548.	297.7	-4.0	0.99
0.08	7.	0.207	4943.	7284.	297.7	-4.0	0.99
0.08	7.	0.207	4987.	7368.	297.7	-4.1	0.99
0.08	7.	0.207	5029.	7447.	297.8	-4.1	0.99
0.08	7.	0.207	5075.	7297.	297.8	-4.1	0.99
0.08	7.	0.207	5122.	7116.	297.8	-4.2	0.99
0.08	7.	0.207	5163.	7618.	297.8	-4.2	0.99
0.27	23.	0.177	5325.	7362.	297.9	-4.2	0.99
0.27	23.	0.177	5366.	7248.	297.9	-4.3	0.99
0.27	23.	0.177	5412.	7248.	297.9	-4.3	0.99
0.27	23.	0.177	5459.	7285.	297.9	-4.3	0.99
0.27	23.	0.177	5511.	7365.	298.0	-4.3	0.99
0.27	23.	0.177	5554.	7522.	298.0	-4.3	0.99
0.27	23.	0.177	5600.	7564.	298.0	-4.3	0.99
0.27	23.	0.177	5642.	7486.	298.0	-4.3	0.99
0.27	23.	0.177	5685.	7219.	298.0	-4.3	0.99
0.27	23.	0.177	5726.	7566.	298.0	-4.3	0.99
0.27	23.	0.177	5771.	7526.	298.0	-4.3	0.99
0.27	23.	0.177	5818.	7567.	298.0	-4.3	0.99
0.27	23.	0.177	5865.	7331.	298.0	-4.3	0.99
0.56	48.	0.180	7893.	7458.	297.4	-3.7	0.99
0.56	48.	0.180	7942.	7661.	297.3	-3.6	0.99
0.56	48.	0.180	7988.	7298.	297.3	-3.6	0.99
0.56	48.	0.180	8031.	7489.	297.3	-3.6	0.99
0.56	48.	0.180	8072.	7564.	297.3	-3.6	0.99
0.56	48.	0.180	8115.	7101.	297.2	-3.6	0.99
0.56	48.	0.180	8159.	7359.	297.2	-3.5	0.99
0.56	48.	0.180	8202.	7166.	297.2	-3.5	0.99
0.56	48.	0.180	8245.	7311.	297.2	-3.5	0.99
0.56	48.	0.180	8296.	7469.	297.1	-3.5	0.99
0.56	48.	0.180	8341.	7309.	297.1	-3.5	0.99
0.56	48.	0.180	8392.	7264.	297.1	-3.4	0.99
0.56	48.	0.180	8449.	7455.	297.1	-3.4	0.99
0.86	73.	0.209	11766.	7187.	295.4	-1.8	1.00
0.86	73.	0.209	11806.	7144.	295.4	-1.7	1.00
0.86	73.	0.209	11848.	7255.	295.4	-1.7	1.00
0.86	73.	0.209	11894.	7252.	295.4	-1.7	1.00
0.86	73.	0.209	11937.	6842.	295.3	-1.7	1.00
0.86	73.	0.209	11984.	7015.	295.3	-1.6	1.00
0.86	73.	0.209	12032.	6976.	295.3	-1.6	1.00
0.86	73.	0.209	12082.	7198.	295.3	-1.6	1.00
0.86	73.	0.209	12124.	7238.	295.3	-1.6	1.00
0.86	73.	0.209	12168.	7153.	295.2	-1.6	1.00
0.86	73.	0.209	12208.	6891.	295.2	-1.6	1.00
0.86	73.	0.209	12252.	7033.	295.2	-1.5	1.00
0.86	73.	0.209	12298.	7030.	295.2	-1.5	1.00
1.08	92.	0.203	12461.	6981.	295.1	-1.4	1.00
1.08	92.	0.203	12506.	6870.	295.1	-1.4	1.00
1.08	92.	0.203	12550.	7163.	295.1	-1.4	1.00
1.08	92.	0.203	12595.	6797.	295.0	-1.4	1.00
1.08	92.	0.203	12637.	6971.	295.0	-1.4	1.00
1.08	92.	0.203	12686.	6654.	295.0	-1.3	1.00
1.08	92.	0.203	12730.	6928.	295.0	-1.3	1.00
1.08	92.	0.203	12773.	6852.	294.9	-1.3	1.00
1.08	92.	0.203	12819.	6883.	294.9	-1.3	1.00
1.08	92.	0.203	12861.	6989.	294.9	-1.2	1.00
1.08	92.	0.203	12903.	6809.	294.9	-1.2	1.00
1.08	92.	0.203	12952.	6945.	294.9	-1.2	1.00
1.08	92.	0.203	12994.	6942.	294.8	-1.2	1.00
1.14	96.	0.208	13180.	6967.	294.8	-1.1	1.00
1.14	96.	0.208	13223.	7115.	294.7	-1.1	1.00
1.14	96.	0.208	13267.	7189.	294.7	-1.1	1.00
1.14	96.	0.208	13309.	6850.	294.7	-1.0	1.00
1.14	96.	0.208	13352.	6744.	294.7	-1.0	1.00
1.14	96.	0.208	13394.	7062.	294.7	-1.0	1.00
1.14	96.	0.208	13439.	6987.	294.6	-1.0	1.00
1.14	96.	0.208	13482.	6980.	294.6	-1.0	1.00
1.14	96.	0.208	13526.	6872.	294.6	-0.9	1.00
1.14	96.	0.208	13569.	7090.	294.6	-0.9	1.00
1.14	96.	0.208	13615.	7125.	294.6	-0.9	1.00
1.14	96.	0.208	13668.	6933.	294.6	-0.9	1.00
1.14	96.	0.208	13730.	7118.	294.5	-0.9	1.00
1.92	163.	0.204	17643.	6787.	293.9	-0.2	1.00
1.92	163.	0.204	17687.	7049.	293.9	-0.2	1.00
1.92	163.	0.204	17730.	7056.	293.9	-0.3	1.00
1.92	163.	0.204	17772.	6981.	293.9	-0.3	1.00
1.92	163.	0.204	17813.	6841.	294.0	-0.3	1.00
1.92	163.	0.204	17853.	6917.	294.0	-0.3	1.00
1.92	163.	0.204	17900.	6885.	294.0	-0.3	1.00
1.92	163.	0.204	17940.	6676.	294.0	-0.4	1.00
1.92	163.	0.204	17982.	7001.	294.1	-0.4	1.00
1.92	163.	0.204	18024.	6967.	294.1	-0.4	1.00
1.92	163.	0.204	18067.	6824.	294.1	-0.4	1.00
1.92	163.	0.204	18109.	7048.	294.1	-0.4	1.00
1.92	163.	0.204	18154.	7011.	294.1	-0.5	1.00
4.07	346.	0.070	22676.	6728.	293.6	0.1	1.00
4.07	346.	0.070	22720.	6628.	293.6	0.0	1.00
4.07	346.	0.070	22763.	6917.	293.7	0.0	1.00
4.07	346.	0.070	22806.	6568.	293.7	0.0	1.00
4.07	346.	0.070	22848.	6999.	293.7	-0.1	1.00
4.07	346.	0.070	22892.	6929.	293.7	-0.1	1.00
4.07	346.	0.070	22939.	6970.	293.8	-0.1	1.00
4.07	346.	0.070	22984.	6903.	293.8	-0.1	1.00
4.07	346.	0.070	23032.	6944.	293.8	-0.2	1.00
4.07	346.	0.070	23076.	7023.	293.9	-0.2	1.00
4.07	346.	0.070	23118.	6600.	293.9	-0.2	1.00
4.07	346.	0.070	23160.	6916.	293.9	-0.3	1.00
4.07	346.	0.070	23203.	6923.	293.9	-0.3	1.00
2.63	224.	0.111	26115.	7046.	293.8	-0.1	1.00
2.63	224.	0.111	26160.	6857.	293.8	-0.1	1.00
2.63	224.	0.111	26208.	6818.	293.8	-0.1	1.00
2.63	224.	0.111	26261.	6604.	293.7	-0.1	1.00
2.63	224.	0.111	26305.	6706.	293.7	-0.1	1.00
2.63	224.	0.111	26354.	6918.	293.7	0.0	1.00
2.63	224.	0.111	26399.	6843.	293.7	0.0	1.00
2.63	224.	0.111	26442.	6914.	293.7	0.0	1.00
2.63	224.	0.111	26511.	7020.	293.6	0.0	1.00
2.63	224.	0.111	26555.	6986.	293.6	0.0	1.00
2.63	224.	0.111	26600.	6831.	293.6	0.0	1.00
2.63	224.	0.111	26644.	6939.	293.6	0.1	1.00
2.63	224.	0.111	26688.	7017.	293.6	0.1	1.00
1.41	119.	0.220	26865.	6740.	293.6	0.1	1.00
1.41	119.	0.220	26911.	6846.	293.5	0.1	1.00
1.41	119.	0.220	26961.	7030.	293.5	0.1	1.00
1.41	119.	0.220	27007.	6911.	293.5	0.2	1.00
1.41	119.	0.220	27054.	6951.	293.5	0.2	1.00
1.41	119.	0.220	27097.	6944.	293.5	0.2	1.00
1.41	119.	0.220	27146.	6766.	293.5	0.2	1.00
1.41	119.	0.220	27192.	6725.	293.5	0.2	1.00
1.41	119.	0.220	27237.	7063.	293.5	0.2	1.00
1.41	119.	0.220	27289.	6623.	293.5	0.2	1.00
1.41	119.	0.220	27333.	6836.	293.5	0.2	1.00
1.41	119.	0.220	27379.	6691.	293.5	0.2	1.00
1.41	119.	0.220	27435.	6730.	293.5	0.2	1.00
0.94	79.	0.216	88904.	6650.	294.1	-0.4	1.00
0.94	79.	0.216	88947.	6578.	294.1	-0.4	1.00
0.94	79.	0.216	88989.	6324.	294.1	-0.4	1.00
0.94	79.	0.216	89031.	6677.	294.1	-0.4	1.00
0.94	79.	0.216	89073.	6645.	294.1	-0.4	1.00
0.94	79.	0.216	89116.	6481.	294.0	-0.4	1.00
0.94	79.	0.216	89164.	6412.	294.0	-0.4	1.00
0.94	79.	0.216	89205.	6605.	294.0	-0.4	1.00
0.94	79.	0.216	89246.	6741.	294.0	-0.3	1.00
0.94	79.	0.216	89289.	6473.	294.0	-0.4	1.00
0.94	79.	0.216	89333.	6502.	294.0	-0.3	1.00
0.94	79.	0.216	89385.	6536.	294.0	-0.3	1.00
0.94	79.	0.216	89435.	6468.	294.0	-0.3	1.00
1.07	91.	0.220	93246.	6237.	294.1	-0.4	1.00
1.07	91.	0.220	93287.	6716.	294.1	-0.4	1.00
1.07	91.	0.220	93328.	6648.	294.1	-0.4	1.00
1.07	91.	0.220	93369.	6614.	294.1	-0.4	1.00
1.07	91.	0.220	93409.	6614.	294.1	-0.4	1.00
1.07	91.	0.220	93456.	6783.	294.1	-0.4	1.00
1.07	91.	0.220	93500.	6680.	294.1	-0.4	1.00
1.07	91.	0.220	93543.	6416.	294.1	-0.4	1.00
1.07	91.	0.220	93588.	6892.	294.1	-0.4	1.00
1.07	91.	0.220	93629.	6477.	294.0	-0.4	1.00

Table H.2.6 Tap water flushing after Re = 4600 contamination tests at x_b = 0.2 % (file:flsh45c1.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
6.62	560.	0.077	2413.	300.1	-6.5	0.99
6.62	560.	0.077	2467.	299.9	-6.4	0.99
6.62	560.	0.077	2522.	299.9	-6.3	0.99
6.62	560.	0.077	2574.	299.9	-6.3	0.99
6.62	560.	0.077	2634.	299.8	-6.3	0.99
6.62	560.	0.077	2686.	299.8	-6.2	0.99
6.62	560.	0.077	2744.	299.7	-6.2	0.99
6.62	560.	0.077	2796.	299.7	-6.1	0.99
6.62	560.	0.077	2849.	299.6	-6.0	0.99
6.62	560.	0.077	2898.	299.5	-5.9	0.99
6.62	560.	0.077	2953.	299.4	-5.8	0.99
6.62	560.	0.077	3000.	299.3	-5.8	0.99
6.02	509.	0.037	3214.	299.1	-5.5	0.99
6.02	509.	0.037	3271.	299.0	-5.5	0.99
6.02	509.	0.037	3326.	298.9	-5.4	0.99
6.02	509.	0.037	3380.	298.9	-5.3	0.99
6.02	509.	0.037	3430.	298.8	-5.3	0.99
6.02	509.	0.037	3481.	298.8	-5.2	0.99
6.02	509.	0.037	3530.	298.7	-5.2	0.99
6.02	509.	0.037	3581.	298.7	-5.1	0.99
6.02	509.	0.037	3631.	298.6	-5.1	0.99
6.02	509.	0.037	3684.	298.6	-5.0	0.99
4.89	416.	0.040	25131.	292.7	0.8	1.00
4.89	416.	0.040	25189.	292.7	0.8	1.00
4.89	416.	0.040	25244.	292.7	0.8	1.00
4.89	416.	0.040	25297.	292.7	0.8	1.00
4.89	416.	0.040	25351.	292.8	0.8	1.00
4.89	416.	0.040	25403.	292.8	0.8	1.00
4.89	416.	0.040	25455.	292.8	0.8	1.00
4.89	416.	0.040	25506.	292.8	0.8	1.00
4.89	416.	0.040	25557.	292.8	0.8	1.00
4.88	415.	0.047	25789.	292.8	0.7	1.00
4.88	415.	0.047	25844.	292.8	0.7	1.00
4.88	415.	0.047	25894.	292.9	0.7	1.00
4.88	415.	0.047	25951.	292.9	0.7	1.00
4.88	415.	0.047	26010.	292.9	0.7	1.00
4.88	415.	0.047	26058.	292.9	0.7	1.00
4.88	415.	0.047	26106.	292.9	0.7	1.00
3.29	280.	0.009	83821.	293.9	-0.3	1.00
3.29	280.	0.009	84083.	293.9	-0.4	1.00
3.29	280.	0.009	84145.	293.9	-0.4	1.00
3.29	280.	0.009	84204.	293.9	-0.4	1.00
3.29	280.	0.009	84256.	293.9	-0.4	1.00
3.29	280.	0.009	84311.	293.9	-0.4	1.00
3.29	280.	0.009	84369.	293.9	-0.4	1.00
3.29	280.	0.009	84456.	293.9	-0.4	1.00
3.29	280.	0.009	84513.	293.9	-0.3	1.00
3.29	280.	0.009	84590.	293.9	-0.4	1.00
3.29	280.	0.009	84641.	293.9	-0.4	1.00
3.29	280.	0.009	84697.	293.9	-0.4	1.00
3.29	280.	0.009	84755.	293.9	-0.4	1.00
3.27	278.	0.022	85420.	294.0	-0.5	1.00
3.27	278.	0.022	85482.	294.0	-0.5	1.00
3.27	278.	0.022	85542.	294.0	-0.5	1.00
3.27	278.	0.022	85595.	294.0	-0.5	1.00
3.27	278.	0.022	85648.	294.0	-0.5	1.00
3.27	278.	0.022	85697.	294.0	-0.5	1.00
3.27	278.	0.022	85750.	294.1	-0.5	1.00
3.27	278.	0.022	85808.	294.0	-0.5	1.00
3.27	278.	0.022	85861.	294.1	-0.5	1.00
3.27	278.	0.022	85913.	294.0	-0.5	1.00
3.27	278.	0.022	85962.	294.0	-0.5	1.00
3.27	278.	0.022	86023.	294.1	-0.5	1.00
3.27	278.	0.022	86073.	294.1	-0.5	1.00
2.46	209.	0.012	111672.	294.0	-0.5	1.00
2.46	209.	0.012	111735.	294.0	-0.5	1.00
2.46	209.	0.012	111793.	294.0	-0.5	1.00
2.46	209.	0.012	111862.	294.0	-0.5	1.00
2.46	209.	0.012	111923.	294.0	-0.5	1.00
2.46	209.	0.012	111976.	294.0	-0.5	1.00
2.46	209.	0.012	112026.	294.0	-0.5	1.00
2.46	209.	0.012	112079.	294.0	-0.5	1.00
2.46	209.	0.012	112131.	294.0	-0.5	1.00
2.46	209.	0.012	112178.	294.0	-0.5	1.00
2.46	209.	0.012	112226.	294.0	-0.5	1.00
2.46	209.	0.012	112269.	294.0	-0.5	1.00
2.46	209.	0.012	112318.	294.0	-0.5	1.00
2.50	212.	0.020	112462.	294.0	-0.5	1.00
2.50	212.	0.020	112513.	294.0	-0.5	1.00
2.50	212.	0.020	112562.	294.0	-0.5	1.00
2.50	212.	0.020	112607.	294.0	-0.5	1.00
2.50	212.	0.020	112651.	294.0	-0.5	1.00
1.94	165.	0.014	169806.	295.0	-1.4	1.00
1.94	165.	0.014	169865.	295.0	-1.4	1.00
1.94	165.	0.014	169922.	295.0	-1.4	1.00
1.94	165.	0.014	169977.	294.9	-1.4	1.00
1.94	165.	0.014	170036.	295.0	-1.4	1.00
1.94	165.	0.014	170093.	294.9	-1.4	1.00
1.94	165.	0.014	170147.	295.0	-1.4	1.00
1.94	165.	0.014	170205.	294.9	-1.4	1.00
1.94	165.	0.014	170261.	295.0	-1.4	1.00
1.94	165.	0.014	170312.	294.9	-1.4	1.00
1.94	165.	0.014	170367.	295.0	-1.4	1.00
1.94	165.	0.014	170416.	294.9	-1.4	1.00
1.94	165.	0.014	170470.	294.9	-1.4	1.00
2.13	181.	0.012	170928.	294.9	-1.4	1.00
2.13	181.	0.012	170986.	294.9	-1.4	1.00
2.13	181.	0.012	171035.	294.9	-1.4	1.00
2.13	181.	0.012	171087.	294.9	-1.4	1.00
2.13	181.	0.012	171142.	294.9	-1.4	1.00
2.13	181.	0.012	171194.	294.9	-1.4	1.00
2.13	181.	0.012	171235.	294.9	-1.4	1.00
2.13	181.	0.012	171288.	294.9	-1.4	1.00
2.13	181.	0.012	171334.	294.9	-1.3	1.00
2.13	181.	0.012	171389.	294.9	-1.3	1.00
2.13	181.	0.012	171429.	294.9	-1.3	1.00
2.13	181.	0.012	171476.	294.9	-1.3	1.00
2.13	181.	0.012	171520.	294.9	-1.3	1.00
1.57	134.	0.027	197155.	294.2	-0.7	1.00
1.57	134.	0.027	197198.	294.2	-0.7	1.00
1.57	134.	0.027	197247.	294.3	-0.7	1.00
1.57	134.	0.027	197290.	294.3	-0.7	1.00
1.57	134.	0.027	197343.	294.3	-0.8	1.00
1.58	134.	0.004	197498.	294.4	-0.8	1.00
1.58	134.	0.004	197541.	294.4	-0.8	1.00
1.58	134.	0.004	197581.	294.4	-0.8	1.00

Table H.2.7 Diesel contamination on oxidized copper surface for Re = 0 and x_b = 0.3 % (file:trv0con2.tb2)

l_e (µm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_r}$ (K)	$T_b - \bar{T}_{T_r}$ (K)	$\frac{F_{T_b}}{F_{T_r}}$
0.61	52.	0.339	2476.	0.	295.4	-1.7	1.00
0.61	52.	0.339	2532.	0.	295.4	-1.7	1.00
0.61	52.	0.339	2592.	0.	295.4	-1.7	1.00
0.61	52.	0.339	2647.	0.	295.3	-1.6	1.00
0.61	52.	0.339	2702.	0.	295.3	-1.6	1.00
0.61	52.	0.339	2763.	0.	295.3	-1.6	1.00
0.61	52.	0.339	2823.	0.	295.3	-1.6	1.00
0.61	52.	0.339	2880.	0.	295.3	-1.6	1.00
0.61	52.	0.339	2939.	0.	295.3	-1.6	1.00
0.61	52.	0.339	3000.	0.	295.3	-1.6	1.00
0.61	52.	0.339	3056.	0.	295.3	-1.6	1.00
0.61	52.	0.339	3118.	0.	295.3	-1.6	1.00
0.61	52.	0.339	3178.	0.	295.2	-1.6	1.00
1.78	151.	0.300	406841.	0.	294.6	-0.9	1.00
1.78	151.	0.300	406899.	0.	294.6	-0.9	1.00
1.78	151.	0.300	406954.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407010.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407065.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407122.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407178.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407234.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407289.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407354.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407410.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407466.	0.	294.6	-0.9	1.00
1.78	151.	0.300	407521.	0.	294.6	-0.9	1.00
2.67	226.	0.283	410253.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410306.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410359.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410412.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410468.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410522.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410577.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410632.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410685.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410739.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410798.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410853.	0.	294.7	-1.0	1.00
2.67	226.	0.283	410915.	0.	294.7	-1.0	1.00
3.17	269.	0.280	414268.	0.	294.9	-1.1	1.00
3.17	269.	0.280	414324.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414380.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414435.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414494.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414545.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414605.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414662.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414717.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414775.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414834.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414889.	0.	294.8	-1.1	1.00
3.17	269.	0.280	414947.	0.	294.8	-1.1	1.00
3.86	327.	0.272	418388.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418457.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418510.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418565.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418620.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418674.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418730.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418783.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418838.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418892.	0.	294.9	-1.2	1.00
3.86	327.	0.272	418945.	0.	294.9	-1.2	1.00
3.86	327.	0.272	419001.	0.	294.9	-1.2	1.00
3.86	327.	0.272	419056.	0.	294.9	-1.2	1.00
4.30	364.	0.259	421712.	0.	294.9	-1.2	1.00
4.30	364.	0.259	421767.	0.	294.9	-1.2	1.00
4.30	364.	0.259	421821.	0.	294.9	-1.2	1.00
4.30	364.	0.259	421888.	0.	294.9	-1.2	1.00
4.30	364.	0.259	421940.	0.	294.9	-1.2	1.00
4.30	364.	0.259	421991.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422044.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422101.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422155.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422206.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422261.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422317.	0.	294.9	-1.2	1.00
4.30	364.	0.259	422372.	0.	294.9	-1.2	1.00
4.45	377.	0.263	425568.	0.	294.9	-1.1	1.00
4.45	377.	0.263	425621.	0.	294.9	-1.2	1.00
4.45	377.	0.263	425677.	0.	294.9	-1.2	1.00
4.45	377.	0.263	425735.	0.	294.9	-1.1	1.00
4.45	377.	0.263	425790.	0.	294.9	-1.2	1.00
4.45	377.	0.263	425843.	0.	294.9	-1.2	1.00
4.45	377.	0.263	425899.	0.	294.9	-1.1	1.00
4.45	377.	0.263	425954.	0.	294.9	-1.1	1.00
4.45	377.	0.263	426011.	0.	294.9	-1.1	1.00
4.45	377.	0.263	426070.	0.	294.9	-1.2	1.00
4.45	377.	0.263	426126.	0.	294.9	-1.2	1.00
4.45	377.	0.263	426179.	0.	294.9	-1.2	1.00
4.45	377.	0.263	426237.	0.	294.9	-1.2	1.00
3.77	319.	0.290	429254.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429314.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429368.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429432.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429509.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429571.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429625.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429684.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429735.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429789.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429844.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429900.	0.	294.8	-1.1	1.00
3.77	319.	0.290	429954.	0.	294.8	-1.1	1.00
3.72	316.	0.267	432844.	0.	294.8	-1.1	1.00
3.72	316.	0.267	432904.	0.	294.7	-1.0	1.00
3.72	316.	0.267	432958.	0.	294.8	-1.1	1.00
3.72	316.	0.267	433013.	0.	294.7	-1.1	1.00
3.72	316.	0.267	433077.	0.	294.7	-1.1	1.00
3.72	316.	0.267	433130.	0.	294.7	-1.1	1.00
3.72	316.	0.267	433190.	0.	294.7	-1.0	1.00
3.72	316.	0.267	433242.	0.	294.7	-1.1	1.00
3.72	316.	0.267	433301.	0.	294.7	-1.1	1.00
3.72	316.	0.267	433361.	0.	294.7	-1.0	1.00
3.72	316.	0.267	433416.	0.	294.7	-1.1	1.00
3.72	316.	0.267	433472.	0.	294.7	-1.0	1.00
3.72	316.	0.267	433527.	0.	294.7	-1.0	1.00
3.41	289.	0.275	494999.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495055.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495113.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495188.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495257.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495315.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495369.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495611.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495673.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495728.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495786.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495839.	0.	294.5	-0.8	1.00
3.41	289.	0.275	495902.	0.	294.5	-0.8	1.00
4.23	358.	0.267	498198.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498282.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498336.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498412.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498495.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498579.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498644.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498708.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498768.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498826.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498883.	0.	294.6	-0.9	1.00
4.23	358.	0.267	498955.	0.	294.6	-0.9	1.00
4.23	358.	0.267	499011.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506417.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506473.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506525.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506579.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506636.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506692.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506755.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506811.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506866.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506921.	0.	294.6	-0.9	1.00
5.72	485.	0.285	506977.	0.	294.6	-0.9	1.00
5.72	485.	0.285	507031.	0.	294.6	-0.9	1.00
5.72	485.	0.285	507090.	0.	294.6	-0.9	1.00
4.54	384.	0.260	82346.	0.	295.6	0.2	1.00

Table H.2.8 Diesel contamination on oxidized copper surface for Re = 2000 and x_b = 0.3 % (file:trv15con2.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
-0.77	-65.	0.335	613.	1909.	294.5	-0.8	1.00
-0.77	-65.	0.335	749.	1961.	294.5	-0.8	1.00
-0.77	-65.	0.335	792.	1984.	294.5	-0.8	1.00
-0.77	-65.	0.335	837.	1903.	294.5	-0.8	1.00
-0.77	-65.	0.335	881.	1914.	294.5	-0.8	1.00
-0.77	-65.	0.335	922.	1982.	294.5	-0.8	1.00
-0.77	-65.	0.335	966.	2003.	294.5	-0.8	1.00
-0.77	-65.	0.335	1008.	1967.	294.5	-0.8	1.00
-0.77	-65.	0.335	1054.	1934.	294.4	-0.8	1.00
-0.77	-65.	0.335	1097.	1983.	294.4	-0.8	1.00
-0.77	-65.	0.335	1138.	1865.	294.4	-0.8	1.00
-0.77	-65.	0.335	1181.	2000.	294.4	-0.7	1.00
-0.77	-65.	0.335	1226.	1945.	294.4	-0.7	1.00
-0.07	-6.	0.310	1374.	1958.	294.4	-0.6	1.00
-0.07	-6.	0.310	1422.	1888.	294.3	-0.7	1.00
-0.07	-6.	0.310	1468.	1975.	294.3	-0.6	1.00
-0.07	-6.	0.310	1513.	1982.	294.3	-0.6	1.00
-0.07	-6.	0.310	1557.	1877.	294.3	-0.6	1.00
-0.07	-6.	0.310	1606.	1898.	294.3	-0.6	1.00
-0.07	-6.	0.310	1652.	1965.	294.2	-0.6	1.00
-0.07	-6.	0.310	1694.	1954.	294.2	-0.5	1.00
-0.07	-6.	0.310	1739.	1911.	294.2	-0.5	1.00
-0.07	-6.	0.310	1786.	1914.	294.1	-0.5	1.00
-0.07	-6.	0.310	1831.	1836.	294.1	-0.5	1.00
-0.07	-6.	0.310	1875.	1953.	294.1	-0.4	1.00
-0.07	-6.	0.310	1919.	1861.	294.1	-0.4	1.00
9.14	772.	0.673	5348.	1811.	293.2	0.4	1.00
9.14	772.	0.673	5391.	1811.	293.2	0.4	1.00
9.14	772.	0.673	5440.	1850.	293.3	0.4	1.00
9.14	772.	0.673	5485.	1723.	293.3	0.4	1.00
9.14	772.	0.673	5528.	1796.	293.3	0.4	1.00
9.14	772.	0.673	5573.	1702.	293.3	0.4	1.00
9.14	772.	0.673	5620.	1788.	293.3	0.3	1.00
9.14	772.	0.673	5667.	1817.	293.3	0.3	1.00
9.14	771.	0.673	5712.	1749.	293.4	0.3	1.00
9.14	771.	0.673	5756.	1713.	293.4	0.3	1.00
9.14	771.	0.673	5804.	1748.	293.4	0.3	1.00
9.14	771.	0.673	5855.	1784.	293.4	0.2	1.00
9.14	771.	0.673	5910.	1691.	293.4	0.2	1.00
15.37	1298.	0.588	11545.	1871.	293.7	0.0	1.00
15.37	1298.	0.588	11590.	1866.	293.7	0.0	1.00
15.37	1298.	0.588	11635.	1864.	293.7	-0.1	1.00
15.37	1298.	0.588	11678.	1848.	293.7	-0.1	1.00
15.37	1298.	0.588	11723.	1866.	293.8	-0.1	1.00
15.37	1298.	0.588	11769.	1875.	293.8	-0.1	1.00
15.37	1298.	0.588	11820.	1897.	293.8	-0.1	1.00
15.37	1298.	0.588	11885.	1873.	293.8	-0.2	1.00
15.37	1298.	0.588	11937.	1911.	293.8	-0.2	1.00
15.37	1298.	0.588	11982.	1881.	293.9	-0.2	1.00
15.37	1298.	0.588	12028.	1803.	293.9	-0.2	1.00
15.37	1298.	0.588	12073.	1789.	293.9	-0.2	1.00
15.37	1298.	0.588	12118.	1852.	293.9	-0.2	1.00
13.56	1149.	0.323	12289.	1923.	293.9	-0.3	1.00
13.56	1149.	0.323	12336.	1804.	293.9	-0.3	1.00
13.56	1149.	0.323	12382.	1873.	293.9	-0.3	1.00
13.56	1149.	0.323	12433.	1873.	293.9	-0.3	1.00
13.56	1149.	0.323	12476.	1827.	293.9	-0.3	1.00
13.56	1149.	0.323	12523.	1887.	293.9	-0.3	1.00
13.56	1149.	0.323	12570.	1829.	293.9	-0.3	1.00
13.56	1149.	0.323	12616.	1889.	293.9	-0.3	1.00
13.56	1149.	0.323	12664.	1803.	293.9	-0.3	1.00
13.56	1149.	0.323	12711.	1816.	293.9	-0.3	1.00
13.56	1149.	0.323	12755.	1897.	293.9	-0.2	1.00
13.56	1149.	0.323	12803.	1839.	293.9	-0.3	1.00
13.56	1149.	0.323	12851.	1820.	293.9	-0.2	1.00
12.76	1081.	0.359	13002.	1819.	293.9	-0.2	1.00
12.76	1081.	0.359	13051.	1896.	293.9	-0.2	1.00
12.76	1081.	0.359	13104.	1907.	293.8	-0.2	1.00
12.76	1081.	0.359	13151.	1801.	293.8	-0.2	1.00
12.76	1081.	0.359	13210.	1897.	293.8	-0.1	1.00
12.76	1081.	0.359	13262.	1865.	293.8	-0.1	1.00
12.76	1081.	0.359	13308.	1888.	293.8	-0.1	1.00
12.76	1081.	0.359	13363.	1824.	293.7	-0.1	1.00
12.76	1081.	0.359	13408.	1797.	293.7	-0.1	1.00
12.76	1081.	0.359	13451.	1797.	293.7	0.0	1.00
12.76	1081.	0.359	13494.	1874.	293.7	0.0	1.00
12.76	1081.	0.359	13537.	1817.	293.7	0.0	1.00
12.76	1081.	0.359	13588.	1846.	293.6	0.0	1.00
18.36	1558.	0.216	73355.	1865.	293.7	-0.1	1.00
18.36	1558.	0.216	73397.	1847.	293.8	-0.1	1.00
18.36	1558.	0.216	73442.	1836.	293.8	-0.1	1.00
18.36	1558.	0.216	73485.	1884.	293.8	-0.1	1.00
18.36	1558.	0.216	73528.	1809.	293.8	-0.2	1.00
18.36	1558.	0.216	73573.	1894.	293.8	-0.2	1.00
18.36	1558.	0.216	73619.	1850.	293.9	-0.2	1.00
18.36	1558.	0.216	73662.	1842.	293.9	-0.2	1.00
18.36	1558.	0.216	73704.	1782.	293.9	-0.2	1.00
18.36	1558.	0.216	73747.	1872.	293.9	-0.2	1.00
18.36	1558.	0.216	73794.	1893.	293.9	-0.3	1.00
18.36	1558.	0.216	73842.	1803.	293.9	-0.3	1.00
18.36	1558.	0.216	73894.	1880.	293.9	-0.3	1.00
18.48	1569.	0.189	77085.	1886.	293.3	0.4	1.00
18.48	1569.	0.189	77131.	1847.	293.3	0.4	1.00
18.48	1569.	0.189	77174.	1780.	293.3	0.4	1.00
18.48	1569.	0.189	77217.	1834.	293.3	0.4	1.00
18.48	1569.	0.189	77258.	1780.	293.3	0.4	1.00
18.48	1569.	0.189	77301.	1861.	293.3	0.4	1.00
18.48	1569.	0.189	77344.	1837.	293.3	0.4	1.00
18.48	1569.	0.189	77387.	1782.	293.3	0.3	1.00
18.48	1569.	0.189	77431.	1806.	293.3	0.3	1.00
18.48	1569.	0.189	77476.	1857.	293.3	0.3	1.00
18.48	1569.	0.189	77518.	1849.	293.4	0.3	1.00
18.48	1569.	0.189	77562.	1857.	293.4	0.3	1.00
18.48	1569.	0.189	77605.	1842.	293.4	0.3	1.00
18.26	1550.	0.173	80433.	1841.	293.6	0.0	1.00
18.26	1550.	0.173	80475.	1812.	293.6	0.1	1.00
18.26	1550.	0.173	80517.	1889.	293.6	0.1	1.00
18.26	1550.	0.173	80561.	1817.	293.6	0.1	1.00
18.26	1550.	0.173	80603.	1885.	293.6	0.1	1.00
18.26	1550.	0.173	80650.	1878.	293.5	0.1	1.00
18.26	1550.	0.173	80695.	1864.	293.5	0.1	1.00
18.26	1550.	0.173	80743.	1861.	293.5	0.2	1.00
18.26	1550.	0.173	80788.	1826.	293.4	0.2	1.00
18.26	1550.	0.173	80833.	1834.	293.4	0.2	1.00
18.26	1550.	0.173	80883.	1825.	293.4	0.3	1.00
18.26	1550.	0.173	80928.	1818.	293.4	0.3	1.00
18.26	1550.	0.173	80973.	1819.	293.4	0.3	1.00
17.83	1513.	0.210	81131.	1791.	293.3	0.4	1.00
17.83	1513.	0.210	81176.	1873.	293.3	0.4	1.00
17.83	1513.	0.210	81219.	1884.	293.3	0.4	1.00
17.83	1513.	0.210	81265.	1801.	293.3	0.4	1.00
17.83	1513.	0.210	81310.	1781.	293.3	0.4	1.00
17.83	1513.	0.210	81354.	1794.	293.2	0.4	1.00
17.83	1513.	0.210	81403.	1763.	293.2	0.4	1.00
17.83	1513.	0.210	81450.	1845.	293.2	0.4	1.00
17.83	1513.	0.210	81494.	1825.	293.2	0.5	1.00
17.83	1513.	0.210	81540.	1826.	293.2	0.4	1.00
17.83	1513.	0.210	81583.	1881.	293.2	0.5	1.00
17.83	1513.	0.210	81629.	1819.	293.2	0.5	1.00
17.83	1513.	0.210	81674.	1874.	293.2	0.5	1.00
17.97	1509.	1.095	84266.	1875.	293.9	-0.3	1.00
17.97	1509.	1.095	84307.	1902.	293.9	-0.3	1.00
17.97	1509.	1.095	84352.	1914.	293.9	-0.3	1.00
17.97	1509.	1.095	84400.	1945.	293.9	-0.3	1.00
17.97	1509.	1.095	84447.	1917.	294.0	-0.3	1.00
17.97	1509.	1.095	84491.	1902.	293.9	-0.3	1.00
17.97	1509.	1.095	84539.	1918.	293.9	-0.3	1.00
17.97	1509.	1.095	84584.	1960.	293.9	-0.3	1.00
17.97	1509.	1.095	84629.	1949.	293.9	-0.3	1.00
17.97	1509.	1.095	84675.	1924.	293.9	-0.3	1.00
17.97	1509.	1.095	84727.	1856.	293.9	-0.3	1.00
17.97	1509.	1.095	84772.	1851.	293.9	-0.3	1.00
17.97	1509.	1.095	84818.	1912.	293.9	-0.3	1.00
17.00	1440.	0.384	91589.	1906.	293.5	0.2	1.00
17.00	1440.	0.384	91636.	1874.	293.4	0.2	1.00
17.00	1440.	0.384	91681.	1924.	293.4	0.3	1.00
17.00	1440.	0.384	91730.	1960.	293.4	0.3	1.00
17.00	1440.	0.384	91781.	1946.	293.4	0.3	1.00
17.00	1440.	0.384	91827.	1938.	293.4	0.3	1.00
17.00	1440.	0.384	91873.	1894.	293.3	0.3	1.00
17.00	1440.	0.384	91918.	1858.	293.3	0.4	1.00
17.00	1440.	0.384	91977.	1876.	293.3	0.3	1.00
17.00	1440.	0.384	92034.	1819.	293.3	0.4	1.00

Table H.2.9 Diesel contamination on oxidized copper surface for Re = 4000 and x_b = 0.3 % (file:trv3con2.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_r}$ (K)	$T_b - \bar{T}_{T_r}$ (K)	$\frac{F_{T_b}}{F_{T_r}}$
11.75	995.	0.302	64840.	3944.	293.9	-0.2	1.00
11.75	995.	0.302	64910.	4053.	293.9	-0.2	1.00
11.75	996.	0.302	64953.	4038.	293.9	-0.2	1.00
11.75	996.	0.302	65012.	3912.	293.8	-0.2	1.00
11.75	996.	0.302	65079.	3984.	293.8	-0.1	1.00
11.75	996.	0.302	65125.	3991.	293.8	-0.1	1.00
11.75	996.	0.302	65175.	4016.	293.8	-0.1	1.00
11.75	996.	0.302	65229.	4003.	293.8	-0.1	1.00
11.75	996.	0.302	65299.	4098.	293.7	0.0	1.00
11.75	996.	0.302	65349.	3970.	293.7	0.0	1.00
11.75	996.	0.302	65421.	3941.	293.6	0.0	1.00
11.75	996.	0.302	65505.	4076.	293.6	0.1	1.00
11.75	996.	0.302	65555.	3885.	293.5	0.1	1.00
12.51	1060.	0.283	68691.	3973.	294.0	-0.3	1.00
12.51	1060.	0.283	68759.	4069.	293.9	-0.2	1.00
12.51	1060.	0.283	68808.	4134.	293.9	-0.2	1.00
12.51	1060.	0.283	68854.	3967.	293.9	-0.2	1.00
12.51	1060.	0.283	68898.	3847.	293.9	-0.2	1.00
12.51	1060.	0.283	68943.	4078.	293.9	-0.2	1.00
12.51	1060.	0.283	69033.	4011.	293.8	-0.2	1.00
12.51	1060.	0.283	69084.	3924.	293.8	-0.1	1.00
12.51	1060.	0.283	69132.	4020.	293.8	-0.1	1.00
12.51	1060.	0.283	69177.	3967.	293.8	-0.1	1.00
12.51	1060.	0.283	69225.	3815.	293.8	-0.1	1.00
12.51	1060.	0.283	69274.	3976.	293.7	-0.1	1.00
12.51	1060.	0.283	69322.	3948.	293.7	0.0	1.00
13.38	1135.	0.235	72093.	3996.	293.9	-0.2	1.00
13.38	1135.	0.235	72139.	4047.	293.9	-0.2	1.00
13.38	1135.	0.235	72186.	4045.	293.9	-0.3	1.00
13.38	1135.	0.235	72236.	3938.	293.9	-0.3	1.00
13.38	1135.	0.235	72284.	4061.	294.0	-0.3	1.00
13.38	1135.	0.235	72331.	4062.	293.9	-0.3	1.00
13.38	1135.	0.235	72379.	3857.	294.0	-0.3	1.00
13.38	1135.	0.235	72428.	4012.	294.0	-0.3	1.00
13.38	1135.	0.235	72482.	3882.	294.0	-0.3	1.00
13.38	1135.	0.235	72531.	4049.	294.0	-0.3	1.00
13.38	1135.	0.235	72577.	3916.	294.0	-0.3	1.00
13.38	1135.	0.235	72621.	4113.	293.9	-0.3	1.00
13.38	1135.	0.235	72668.	3961.	293.9	-0.3	1.00
13.78	1168.	0.286	76231.	4045.	294.0	-0.3	1.00
13.78	1168.	0.286	76278.	3997.	294.0	-0.3	1.00
13.78	1168.	0.286	76326.	3821.	294.0	-0.3	1.00
13.78	1168.	0.286	76375.	3949.	294.0	-0.3	1.00
13.78	1168.	0.286	76421.	3973.	294.0	-0.3	1.00
13.78	1168.	0.286	76475.	4023.	294.0	-0.3	1.00
13.78	1168.	0.286	76523.	4025.	294.0	-0.3	1.00
13.78	1168.	0.286	76568.	3854.	294.0	-0.3	1.00
13.78	1168.	0.286	76613.	3867.	294.0	-0.3	1.00
13.78	1168.	0.286	76659.	4023.	294.0	-0.3	1.00
13.78	1168.	0.286	76707.	4124.	293.9	-0.3	1.00
13.78	1168.	0.286	76755.	4123.	293.9	-0.3	1.00
13.78	1168.	0.286	76826.	4020.	293.9	-0.3	1.00
14.05	1191.	0.273	79482.	4022.	293.5	0.1	1.00
14.05	1191.	0.273	79525.	3912.	293.5	0.1	1.00
14.05	1191.	0.273	79573.	3937.	293.6	0.1	1.00
14.05	1191.	0.273	79620.	3813.	293.6	0.1	1.00
14.05	1191.	0.273	79661.	3837.	293.6	0.1	1.00
14.05	1191.	0.273	79706.	3803.	293.6	0.0	1.00
14.05	1191.	0.273	79753.	3842.	293.7	0.0	1.00
14.05	1191.	0.273	79848.	3988.	293.7	-0.1	1.00
14.05	1191.	0.273	79914.	3956.	293.8	-0.1	1.00
14.05	1191.	0.273	79965.	3970.	293.8	-0.1	1.00
14.05	1191.	0.273	80013.	3924.	293.8	-0.1	1.00
14.05	1191.	0.273	80063.	3812.	293.9	-0.2	1.00
14.05	1191.	0.273	80110.	3815.	293.9	-0.2	1.00
15.02	1274.	0.199	84094.	3981.	293.9	-0.2	1.00
15.02	1274.	0.199	84157.	4031.	293.9	-0.2	1.00
15.02	1274.	0.199	84212.	3946.	293.9	-0.2	1.00
15.02	1274.	0.199	84261.	4025.	293.9	-0.3	1.00
15.02	1274.	0.199	84310.	3868.	293.9	-0.3	1.00
15.02	1274.	0.199	84356.	3859.	293.9	-0.3	1.00
15.02	1274.	0.199	84404.	3871.	294.0	-0.3	1.00
15.02	1274.	0.199	84450.	4090.	294.0	-0.3	1.00
15.02	1274.	0.199	84493.	3990.	294.0	-0.3	1.00
15.02	1274.	0.199	84538.	4131.	294.0	-0.3	1.00
15.02	1274.	0.199	84588.	4066.	294.0	-0.3	1.00
15.02	1274.	0.199	84634.	3930.	294.0	-0.3	1.00
15.02	1274.	0.199	84678.	4092.	294.0	-0.3	1.00
23.80	2022.	0.145	144804.	4068.	293.6	0.1	1.00
23.80	2022.	0.145	144848.	3958.	293.6	0.1	1.00
23.80	2022.	0.145	144892.	3936.	293.6	0.1	1.00
23.80	2021.	0.145	144934.	3913.	293.6	0.1	1.00
23.80	2021.	0.145	144980.	3893.	293.6	0.0	1.00
23.80	2021.	0.145	145026.	4040.	293.7	0.0	1.00
23.80	2021.	0.145	145072.	3873.	293.7	0.0	1.00
23.80	2021.	0.145	145116.	3899.	293.7	-0.1	1.00
23.80	2021.	0.145	145162.	3984.	293.7	-0.1	1.00
23.80	2021.	0.145	145208.	3915.	293.8	-0.1	1.00
23.80	2021.	0.145	145252.	3804.	293.8	-0.1	1.00
23.80	2021.	0.145	145300.	4055.	293.8	-0.1	1.00
23.80	2021.	0.145	145348.	3982.	293.8	-0.2	1.00
24.33	2067.	0.108	149421.	3743.	293.8	-0.2	1.00
24.33	2067.	0.108	149465.	3845.	293.9	-0.2	1.00
24.33	2067.	0.108	149507.	3941.	293.9	-0.2	1.00
24.33	2067.	0.108	149552.	3906.	293.9	-0.2	1.00
24.33	2067.	0.108	149600.	4028.	293.9	-0.2	1.00
24.33	2067.	0.108	149642.	4015.	293.9	-0.3	1.00
24.33	2067.	0.108	149690.	4015.	293.9	-0.3	1.00
24.33	2067.	0.108	149739.	3829.	293.9	-0.3	1.00
24.33	2067.	0.108	149785.	4008.	294.0	-0.3	1.00
24.33	2067.	0.108	149833.	4020.	293.9	-0.3	1.00
24.33	2067.	0.108	149877.	4055.	293.9	-0.3	1.00
24.33	2067.	0.108	149922.	3810.	294.0	-0.3	1.00
24.33	2067.	0.108	149971.	3786.	293.9	-0.3	1.00
32.28	2726.	0.615	152899.	3913.	293.5	0.2	1.00
32.28	2726.	0.615	152946.	3832.	293.5	0.1	1.00
32.28	2726.	0.615	152989.	3801.	293.5	0.1	1.00
32.28	2726.	0.615	153034.	3930.	293.6	0.1	1.00
32.28	2726.	0.615	153079.	3825.	293.6	0.1	1.00
32.28	2726.	0.615	153127.	3934.	293.6	0.1	1.00
32.28	2726.	0.615	153172.	3877.	293.6	0.0	1.00
32.28	2726.	0.615	153215.	3868.	293.6	0.0	1.00
32.28	2726.	0.615	153260.	3846.	293.7	0.0	1.00
32.28	2726.	0.615	153300.	3780.	293.7	0.0	1.00
32.28	2726.	0.615	153351.	3994.	293.7	-0.1	1.00
32.28	2726.	0.615	153398.	3764.	293.8	-0.1	1.00
32.28	2726.	0.615	153445.	3868.	293.8	-0.1	1.00
25.27	2148.	0.095	159952.	3762.	293.3	0.4	1.00
25.27	2148.	0.095	159997.	3853.	293.3	0.4	1.00
25.27	2148.	0.095	160042.	3772.	293.3	0.4	1.00
25.27	2148.	0.095	160086.	3759.	293.3	0.4	1.00
25.27	2148.	0.095	160128.	3828.	293.3	0.4	1.00
25.27	2148.	0.095	160170.	3749.	293.3	0.4	1.00
25.27	2148.	0.095	160221.	3738.	293.3	0.4	1.00
25.27	2148.	0.095	160264.	3897.	293.3	0.4	1.00
25.27	2148.	0.095	160307.	3932.	293.3	0.4	1.00
25.27	2148.	0.095	160352.	3726.	293.3	0.4	1.00
25.27	2148.	0.095	160399.	3816.	293.3	0.4	1.00
25.27	2148.	0.095	160443.	3738.	293.3	0.4	1.00
25.27	2148.	0.095	160489.	3957.	293.3	0.4	1.00
25.68	2182.	0.100	163842.	3859.	293.4	0.3	1.00
25.68	2182.	0.100	163886.	3939.	293.4	0.3	1.00
25.68	2182.	0.100	163935.	3924.	293.3	0.4	1.00
25.68	2182.	0.100	163984.	3753.	293.3	0.4	1.00
25.68	2182.	0.100	164030.	3751.	293.3	0.4	1.00
25.68	2182.	0.100	164077.	3851.	293.3	0.4	1.00
25.68	2182.	0.100	164121.	3899.	293.3	0.4	1.00
25.68	2182.	0.100	164166.	3932.	293.3	0.4	1.00
25.68	2182.	0.100	164214.	3896.	293.3	0.4	1.00
25.68	2182.	0.100	164262.	3783.	293.3	0.4	1.00
25.68	2182.	0.100	164307.	3943.	293.3	0.4	1.00
25.68	2182.	0.100	164351.	3967.	293.3	0.4	1.00
25.68	2182.	0.100	164398.	3792.	293.3	0.4	1.00
24.46	2071.	0.393	404186.	3646.	293.9	-0.2	1.00
24.46	2071.	0.393	404233.	3720.	293.9	-0.2	1.00
24.46	2071.	0.393	404282.	3721.	293.9	-0.2	1.00
24.46	2071.	0.393	404327.	3629.	293.9	-0.2	1.00
24.46	2071.	0.393	404373.	3560.	293.9	-0.2	1.00
24.46	2071.	0.393	404418.	3673.	293.9	-0.3	1.00
24.46	2071.	0.393	404463.	3735.	293.9	-0.3	1.00
24.46	2071.	0.393	404509.	3706.	293.9	-0.3	1.00
24.46	2071.	0.393	404554.	3737.	293.9	-0.3	1.00
24.46	2071.	0.393	404599.	3814.	293.9	-0.3	1.00

Table H.2.10 Diesel contamination on oxidized copper surface for Re = 5000 and x_b = 0.3 % (file:trv45con2.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
0.38	32.	0.287	4061.	4853.	292.4	1.3	1.00
0.38	32.	0.287	4103.	4993.	292.4	1.2	1.00
0.38	32.	0.287	4144.	4998.	292.5	1.2	1.00
0.38	32.	0.287	4187.	5021.	292.5	1.1	1.00
0.38	32.	0.287	4229.	4870.	292.6	1.1	1.00
0.38	32.	0.287	4271.	4951.	292.6	1.1	1.00
0.38	32.	0.287	4315.	4955.	292.6	1.0	1.00
0.38	32.	0.287	4360.	5059.	292.7	1.0	1.00
0.38	32.	0.287	4402.	5106.	292.7	1.0	1.00
0.38	32.	0.287	4444.	4952.	292.7	0.9	1.00
0.38	32.	0.287	4488.	4859.	292.8	0.9	1.00
0.38	32.	0.287	4530.	4736.	292.8	0.8	1.00
0.38	32.	0.287	4574.	5085.	292.9	0.8	1.00
-0.06	-5.	0.346	4733.	5079.	293.0	0.7	1.00
-0.06	-5.	0.346	4776.	5062.	293.1	0.6	1.00
-0.06	-5.	0.346	4819.	4892.	293.1	0.6	1.00
-0.06	-5.	0.346	4862.	5013.	293.1	0.5	1.00
-0.06	-5.	0.346	4903.	4882.	293.2	0.5	1.00
-0.06	-5.	0.346	4948.	5062.	293.2	0.5	1.00
-0.06	-5.	0.346	4990.	4912.	293.3	0.4	1.00
-0.06	-5.	0.346	5032.	5072.	293.3	0.4	1.00
-0.06	-5.	0.346	5077.	4922.	293.4	0.3	1.00
-0.06	-5.	0.346	5121.	5061.	293.4	0.3	1.00
-0.06	-5.	0.346	5163.	4930.	293.4	0.2	1.00
-0.06	-5.	0.346	5205.	4806.	293.5	0.2	1.00
-0.06	-5.	0.346	5247.	5074.	293.5	0.1	1.00
0.32	27.	0.339	7217.	5000.	294.4	-0.7	1.00
0.32	27.	0.339	7260.	4980.	294.4	-0.7	1.00
0.32	27.	0.339	7312.	5236.	294.3	-0.7	1.00
0.32	27.	0.339	7363.	5034.	294.3	-0.7	1.00
0.32	27.	0.339	7418.	5131.	294.3	-0.6	1.00
0.32	27.	0.339	7466.	5232.	294.3	-0.6	1.00
0.32	27.	0.339	7510.	5186.	294.3	-0.6	1.00
0.32	27.	0.339	7553.	5165.	294.3	-0.6	1.00
0.32	27.	0.339	7596.	5225.	294.3	-0.6	1.00
0.32	27.	0.339	7638.	5225.	294.2	-0.6	1.00
0.32	27.	0.339	7682.	5265.	294.2	-0.6	1.00
0.32	27.	0.339	7724.	5019.	294.2	-0.6	1.00
0.32	27.	0.339	7767.	5077.	294.2	-0.5	1.00
0.65	55.	0.310	72772.	5330.	294.0	-0.3	1.00
0.65	55.	0.310	72816.	5331.	294.1	-0.4	1.00
0.65	55.	0.310	72863.	5354.	294.1	-0.4	1.00
0.65	55.	0.310	72904.	5161.	294.1	-0.4	1.00
0.65	55.	0.310	72945.	5466.	294.1	-0.4	1.00
0.65	55.	0.310	72988.	5422.	294.1	-0.4	1.00
0.65	55.	0.310	73030.	5314.	294.1	-0.4	1.00
0.65	55.	0.310	73071.	5358.	294.1	-0.4	1.00
0.65	55.	0.310	73115.	5314.	294.1	-0.4	1.00
0.65	55.	0.310	73157.	5401.	294.1	-0.4	1.00
0.65	55.	0.310	73202.	5446.	294.1	-0.4	1.00
0.65	55.	0.310	73245.	5126.	294.1	-0.4	1.00
0.65	55.	0.310	73286.	5291.	294.1	-0.4	1.00
0.48	41.	0.313	73421.	5166.	294.1	-0.4	1.00
0.48	41.	0.313	73462.	5493.	294.1	-0.4	1.00
0.48	41.	0.313	73506.	5443.	294.1	-0.4	1.00
0.48	41.	0.313	73548.	5224.	294.1	-0.4	1.00
0.48	41.	0.313	73591.	5182.	294.1	-0.4	1.00
0.48	41.	0.313	73636.	5203.	294.0	-0.4	1.00
0.48	41.	0.313	73680.	5328.	294.0	-0.4	1.00
0.48	41.	0.313	73727.	5373.	294.0	-0.3	1.00
0.48	41.	0.313	73771.	5218.	294.0	-0.3	1.00
0.48	41.	0.313	73813.	5348.	294.0	-0.3	1.00
0.48	41.	0.313	73855.	5237.	294.0	-0.3	1.00
0.48	41.	0.313	73899.	5215.	294.0	-0.3	1.00
0.48	41.	0.313	73943.	5523.	294.0	-0.3	1.00
0.56	47.	0.310	74123.	5339.	293.9	-0.3	1.00
0.56	47.	0.310	74167.	5165.	293.9	-0.2	1.00
0.56	47.	0.310	74210.	5290.	293.9	-0.2	1.00
0.56	47.	0.310	74255.	5264.	293.9	-0.2	1.00
0.56	47.	0.310	74298.	5242.	293.9	-0.2	1.00
0.56	47.	0.310	74342.	5136.	293.8	-0.2	1.00
0.56	47.	0.310	74388.	5256.	293.8	-0.1	1.00
0.56	47.	0.310	74432.	5299.	293.8	-0.1	1.00
0.56	47.	0.310	74477.	5339.	293.8	-0.1	1.00
0.56	47.	0.310	74522.	5009.	293.8	-0.1	1.00
0.56	47.	0.310	74567.	5381.	293.7	-0.1	1.00
0.56	47.	0.310	74612.	5224.	293.7	-0.1	1.00
0.56	47.	0.310	74658.	5080.	293.7	0.0	1.00
1.34	113.	0.234	78825.	5174.	293.9	-0.3	1.00
1.34	113.	0.234	78868.	5032.	293.9	-0.2	1.00
1.34	113.	0.234	78917.	5407.	293.9	-0.2	1.00
1.34	113.	0.234	78963.	5188.	293.9	-0.2	1.00
1.34	113.	0.234	79005.	5493.	293.9	-0.2	1.00
1.34	113.	0.234	79047.	5290.	293.9	-0.2	1.00
1.34	113.	0.234	79091.	5221.	293.8	-0.2	1.00
1.34	113.	0.234	79137.	5371.	293.8	-0.1	1.00
1.34	113.	0.234	79181.	5219.	293.8	-0.1	1.00
1.34	113.	0.234	79224.	4997.	293.8	-0.1	1.00
1.34	113.	0.234	79266.	5387.	293.7	-0.1	1.00
1.34	113.	0.234	79306.	5275.	293.7	-0.1	1.00
1.34	113.	0.234	79349.	5008.	293.7	-0.1	1.00
1.04	88.	0.286	82735.	5361.	294.1	-0.4	1.00
1.04	88.	0.286	82782.	5274.	294.1	-0.4	1.00
1.04	88.	0.286	82827.	5107.	294.1	-0.4	1.00
1.04	88.	0.286	82877.	5230.	294.1	-0.4	1.00
1.04	88.	0.286	82921.	5378.	294.1	-0.4	1.00
1.04	88.	0.286	82965.	5424.	294.1	-0.4	1.00
1.04	88.	0.286	83007.	5207.	294.1	-0.4	1.00
1.04	88.	0.286	83048.	5122.	294.1	-0.4	1.00
1.04	88.	0.286	83093.	5122.	294.1	-0.4	1.00
1.04	88.	0.286	83138.	5267.	294.0	-0.4	1.00
1.04	88.	0.286	83182.	5352.	294.0	-0.4	1.00
1.04	88.	0.286	83227.	5287.	294.0	-0.3	1.00
1.04	88.	0.286	83271.	5139.	294.0	-0.4	1.00
1.18	100.	0.297	85857.	5372.	293.5	0.2	1.00
1.18	100.	0.297	85901.	5217.	293.5	0.2	1.00
1.18	100.	0.297	85946.	5098.	293.5	0.2	1.00
1.18	100.	0.297	85989.	5200.	293.5	0.1	1.00
1.18	100.	0.297	86032.	5289.	293.5	0.1	1.00
1.18	100.	0.297	86077.	5426.	293.6	0.1	1.00
1.18	100.	0.297	86120.	5338.	293.6	0.1	1.00
1.18	100.	0.297	86164.	5210.	293.6	0.1	1.00
1.18	100.	0.297	86211.	5212.	293.6	0.1	1.00
1.18	100.	0.297	86254.	5412.	293.6	0.0	1.00
1.18	100.	0.297	86299.	5195.	293.6	0.0	1.00
1.18	100.	0.297	86344.	5264.	293.7	0.0	1.00
1.18	100.	0.297	86392.	5399.	293.7	0.0	1.00
1.17	100.	0.310	86538.	5386.	293.8	-0.1	1.00
1.17	100.	0.310	86584.	5278.	293.8	-0.1	1.00
1.17	100.	0.310	86626.	5156.	293.8	-0.1	1.00
1.17	100.	0.310	86671.	5351.	293.8	-0.2	1.00
1.17	100.	0.310	86721.	5375.	293.9	-0.2	1.00
1.17	100.	0.310	86765.	5471.	293.9	-0.3	1.00
1.17	100.	0.310	86810.	5230.	293.9	-0.3	1.00
1.17	100.	0.310	86855.	5316.	293.9	-0.3	1.00
1.17	100.	0.310	86900.	5387.	294.0	-0.3	1.00
1.17	100.	0.310	86947.	5154.	294.0	-0.3	1.00
1.17	100.	0.310	86992.	5258.	294.0	-0.3	1.00
1.17	100.	0.310	87035.	5373.	294.0	-0.3	1.00
1.17	100.	0.310	87081.	5439.	294.0	-0.4	1.00
1.44	122.	0.301	90303.	5249.	293.4	0.3	1.00
1.44	122.	0.301	90351.	5360.	293.4	0.3	1.00
1.44	122.	0.301	90403.	5255.	293.4	0.3	1.00
1.44	122.	0.301	90451.	5387.	293.4	0.2	1.00
1.44	122.	0.301	90497.	5232.	293.4	0.2	1.00
1.44	122.	0.301	90539.	5298.	293.4	0.2	1.00
1.44	122.	0.301	90584.	5091.	293.4	0.2	1.00
1.44	122.	0.301	90629.	5215.	293.5	0.2	1.00
1.44	122.	0.301	90673.	5262.	293.5	0.2	1.00
1.44	122.	0.301	90715.	4999.	293.5	0.2	1.00
1.44	122.	0.301	90758.	5307.	293.5	0.1	1.00
1.44	122.	0.301	90803.	5080.	293.5	0.1	1.00
1.44	122.	0.301	90848.	5270.	293.5	0.1	1.00
1.67	142.	0.304	93827.	5326.	293.6	0.0	1.00
1.67	142.	0.304	93869.	5258.	293.6	0.0	1.00
1.67	142.	0.304	93921.	5256.	293.6	0.1	1.00
1.67	142.	0.304	93972.	5027.	293.6	0.1	1.00
1.67	142.	0.304	94019.	4966.	293.5	0.1	1.00
1.67	142.	0.304	94097.	5330.	293.5	0.2	1.00
1.67	142.	0.304	94223.	5214.	293.4	0.2	1.00
1.67	142.	0.304	94280.	5008.	293.4	0.3	1.00
1.67	142.	0.304	94342.	5128.	293.4	0.3	1.00
1.67	142.	0.304	94392.	5023.	293.4	0.3	1.00
1.67	142.	0.304	94438.	5142.	293.4	0.3	1.00
1.67	142.	0.304	94482.	5249.	293.4	0.3	1.00
1.67	142.	0.304	94536.	5039.	293.4	0.3	1.00
1.81	153.	0.299	94678.	5099.	293.4	0.3	1.00

Table H.2.11 Diesel contamination on oxidized copper surface for Re = 7000 and x_b = 0.3 % (file:trv6con2.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	Re	$\bar{T}_{T_T}$ (K)	$T_b - \bar{T}_{T_T}$ (K)	$\frac{F_{T_b}}{F_{T_T}}$
0.38	32.	0.287	4061.	4853.	292.4	1.3	1.00
0.38	32.	0.287	4103.	4993.	292.4	1.2	1.00
0.38	32.	0.287	4144.	4998.	292.5	1.2	1.00
0.38	32.	0.287	4187.	5021.	292.5	1.1	1.00
0.38	32.	0.287	4229.	4870.	292.6	1.1	1.00
0.38	32.	0.287	4271.	4951.	292.6	1.1	1.00
0.38	32.	0.287	4315.	4955.	292.6	1.0	1.00
0.38	32.	0.287	4360.	5059.	292.7	1.0	1.00
0.38	32.	0.287	4402.	5106.	292.7	1.0	1.00
0.38	32.	0.287	4444.	4952.	292.7	0.9	1.00
0.38	32.	0.287	4488.	4859.	292.8	0.9	1.00
0.38	32.	0.287	4530.	4736.	292.8	0.8	1.00
0.38	32.	0.287	4574.	5085.	292.9	0.8	1.00
-0.06	-5.	0.346	4733.	5079.	293.0	0.7	1.00
-0.06	-5.	0.346	4776.	5062.	293.1	0.6	1.00
-0.06	-5.	0.346	4819.	4892.	293.1	0.6	1.00
-0.06	-5.	0.346	4862.	5013.	293.1	0.5	1.00
-0.06	-5.	0.346	4903.	4882.	293.2	0.5	1.00
-0.06	-5.	0.346	4948.	5062.	293.2	0.5	1.00
-0.06	-5.	0.346	4990.	4912.	293.3	0.4	1.00
-0.06	-5.	0.346	5032.	5072.	293.3	0.4	1.00
-0.06	-5.	0.346	5077.	4922.	293.4	0.3	1.00
-0.06	-5.	0.346	5121.	5061.	293.4	0.3	1.00
-0.06	-5.	0.346	5163.	4930.	293.4	0.2	1.00
-0.06	-5.	0.346	5205.	4806.	293.5	0.2	1.00
-0.06	-5.	0.346	5247.	5074.	293.5	0.1	1.00
0.32	27.	0.339	7217.	5000.	294.4	-0.7	1.00
0.32	27.	0.339	7260.	4980.	294.4	-0.7	1.00
0.32	27.	0.339	7312.	5236.	294.3	-0.7	1.00
0.32	27.	0.339	7363.	5034.	294.3	-0.7	1.00
0.32	27.	0.339	7418.	5131.	294.3	-0.6	1.00
0.32	27.	0.339	7466.	5232.	294.3	-0.6	1.00
0.32	27.	0.339	7510.	5186.	294.3	-0.6	1.00
0.32	27.	0.339	7553.	5165.	294.3	-0.6	1.00
0.32	27.	0.339	7596.	5225.	294.3	-0.6	1.00
0.32	27.	0.339	7638.	5225.	294.2	-0.6	1.00
0.32	27.	0.339	7682.	5265.	294.2	-0.6	1.00
0.32	27.	0.339	7724.	5019.	294.2	-0.6	1.00
0.32	27.	0.339	7767.	5077.	294.2	-0.5	1.00
0.65	55.	0.310	72772.	5330.	294.0	-0.3	1.00
0.65	55.	0.310	72816.	5331.	294.1	-0.4	1.00
0.65	55.	0.310	72863.	5354.	294.1	-0.4	1.00
0.65	55.	0.310	72904.	5161.	294.1	-0.4	1.00
0.65	55.	0.310	72945.	5466.	294.1	-0.4	1.00
0.65	55.	0.310	72988.	5422.	294.1	-0.4	1.00
0.65	55.	0.310	73030.	5314.	294.1	-0.4	1.00
0.65	55.	0.310	73071.	5358.	294.1	-0.4	1.00
0.65	55.	0.310	73115.	5314.	294.1	-0.4	1.00
0.65	55.	0.310	73157.	5401.	294.1	-0.4	1.00
0.65	55.	0.310	73202.	5446.	294.1	-0.4	1.00
0.65	55.	0.310	73245.	5126.	294.1	-0.4	1.00
0.65	55.	0.310	73286.	5291.	294.1	-0.4	1.00
0.48	41.	0.313	73421.	5166.	294.1	-0.4	1.00
0.48	41.	0.313	73462.	5493.	294.1	-0.4	1.00
0.48	41.	0.313	73506.	5443.	294.1	-0.4	1.00
0.48	41.	0.313	73548.	5224.	294.1	-0.4	1.00
0.48	41.	0.313	73591.	5182.	294.1	-0.4	1.00
0.48	41.	0.313	73636.	5203.	294.0	-0.4	1.00
0.48	41.	0.313	73680.	5328.	294.0	-0.4	1.00
0.48	41.	0.313	73727.	5373.	294.0	-0.3	1.00
0.48	41.	0.313	73771.	5218.	294.0	-0.3	1.00
0.48	41.	0.313	73813.	5348.	294.0	-0.3	1.00
0.48	41.	0.313	73855.	5237.	294.0	-0.3	1.00
0.48	41.	0.313	73899.	5215.	294.0	-0.3	1.00
0.48	41.	0.313	73943.	5523.	294.0	-0.3	1.00
0.56	47.	0.310	74123.	5339.	293.9	-0.3	1.00
0.56	47.	0.310	74167.	5165.	293.9	-0.2	1.00
0.56	47.	0.310	74210.	5290.	293.9	-0.2	1.00
0.56	47.	0.310	74255.	5264.	293.9	-0.2	1.00
0.56	47.	0.310	74298.	5242.	293.9	-0.2	1.00
0.56	47.	0.310	74342.	5136.	293.8	-0.2	1.00
0.56	47.	0.310	74388.	5256.	293.8	-0.1	1.00
0.56	47.	0.310	74432.	5299.	293.8	-0.1	1.00
0.56	47.	0.310	74477.	5339.	293.8	-0.1	1.00
0.56	47.	0.310	74522.	5009.	293.8	-0.1	1.00
0.56	47.	0.310	74567.	5381.	293.7	-0.1	1.00
0.56	47.	0.310	74612.	5224.	293.7	-0.1	1.00
0.56	47.	0.310	74658.	5080.	293.7	0.0	1.00
1.34	113.	0.234	78825.	5174.	293.9	-0.3	1.00
1.34	113.	0.234	78868.	5032.	293.9	-0.2	1.00
1.34	113.	0.234	78917.	5407.	293.9	-0.2	1.00
1.34	113.	0.234	78963.	5188.	293.9	-0.2	1.00
1.34	113.	0.234	79005.	5493.	293.9	-0.2	1.00
1.34	113.	0.234	79047.	5290.	293.9	-0.2	1.00
1.34	113.	0.234	79091.	5221.	293.8	-0.2	1.00
1.34	113.	0.234	79137.	5371.	293.8	-0.1	1.00
1.34	113.	0.234	79181.	5219.	293.8	-0.1	1.00
1.34	113.	0.234	79224.	4997.	293.8	-0.1	1.00
1.34	113.	0.234	79266.	5387.	293.7	-0.1	1.00
1.34	113.	0.234	79306.	5275.	293.7	-0.1	1.00
1.34	113.	0.234	79349.	5008.	293.7	-0.1	1.00
1.04	88.	0.286	82735.	5361.	294.1	-0.4	1.00
1.04	88.	0.286	82782.	5274.	294.1	-0.4	1.00
1.04	88.	0.286	82827.	5107.	294.1	-0.4	1.00
1.04	88.	0.286	82877.	5230.	294.1	-0.4	1.00
1.04	88.	0.286	82921.	5378.	294.1	-0.4	1.00
1.04	88.	0.286	82965.	5424.	294.1	-0.4	1.00
1.04	88.	0.286	83007.	5207.	294.1	-0.4	1.00
1.04	88.	0.286	83048.	5122.	294.1	-0.4	1.00
1.04	88.	0.286	83093.	5122.	294.1	-0.4	1.00
1.04	88.	0.286	83138.	5267.	294.0	-0.4	1.00
1.04	88.	0.286	83182.	5352.	294.0	-0.4	1.00
1.04	88.	0.286	83227.	5287.	294.0	-0.3	1.00
1.04	88.	0.286	83271.	5139.	294.0	-0.4	1.00
1.18	100.	0.297	85857.	5372.	293.5	0.2	1.00
1.18	100.	0.297	85901.	5217.	293.5	0.2	1.00
1.18	100.	0.297	85946.	5098.	293.5	0.2	1.00
1.18	100.	0.297	85989.	5200.	293.5	0.1	1.00
1.18	100.	0.297	86032.	5289.	293.5	0.1	1.00
1.18	100.	0.297	86077.	5426.	293.6	0.1	1.00
1.18	100.	0.297	86120.	5338.	293.6	0.1	1.00
1.18	100.	0.297	86164.	5210.	293.6	0.1	1.00
1.18	100.	0.297	86211.	5212.	293.6	0.1	1.00
1.18	100.	0.297	86254.	5412.	293.6	0.0	1.00
1.18	100.	0.297	86299.	5195.	293.6	0.0	1.00
1.18	100.	0.297	86344.	5264.	293.7	0.0	1.00
1.18	100.	0.297	86392.	5399.	293.7	0.0	1.00
1.17	100.	0.310	86538.	5386.	293.8	-0.1	1.00
1.17	100.	0.310	86584.	5278.	293.8	-0.1	1.00
1.17	100.	0.310	86626.	5156.	293.8	-0.1	1.00
1.17	100.	0.310	86671.	5351.	293.8	-0.2	1.00
1.17	100.	0.310	86721.	5375.	293.9	-0.2	1.00
1.17	100.	0.310	86765.	5471.	293.9	-0.3	1.00
1.17	100.	0.310	86810.	5230.	293.9	-0.3	1.00
1.17	100.	0.310	86855.	5316.	293.9	-0.3	1.00
1.17	100.	0.310	86900.	5387.	294.0	-0.3	1.00
1.17	100.	0.310	86947.	5154.	294.0	-0.3	1.00
1.17	100.	0.310	86992.	5258.	294.0	-0.3	1.00
1.17	100.	0.310	87035.	5373.	294.0	-0.3	1.00
1.17	100.	0.310	87081.	5439.	294.0	-0.4	1.00
1.44	122.	0.301	90303.	5249.	293.4	0.3	1.00
1.44	122.	0.301	90351.	5360.	293.4	0.3	1.00
1.44	122.	0.301	90403.	5255.	293.4	0.3	1.00
1.44	122.	0.301	90451.	5387.	293.4	0.2	1.00
1.44	122.	0.301	90497.	5232.	293.4	0.2	1.00
1.44	122.	0.301	90539.	5298.	293.4	0.2	1.00
1.44	122.	0.301	90584.	5091.	293.4	0.2	1.00
1.44	122.	0.301	90629.	5215.	293.5	0.2	1.00
1.44	122.	0.301	90673.	5262.	293.5	0.2	1.00
1.44	122.	0.301	90715.	4999.	293.5	0.2	1.00
1.44	122.	0.301	90758.	5307.	293.5	0.1	1.00
1.44	122.	0.301	90803.	5080.	293.5	0.1	1.00
1.44	122.	0.301	90848.	5270.	293.5	0.1	1.00
1.67	142.	0.304	93827.	5326.	293.6	0.0	1.00
1.67	142.	0.304	93869.	5258.	293.6	0.0	1.00
1.67	142.	0.304	93921.	5256.	293.6	0.1	1.00
1.67	142.	0.304	93972.	5027.	293.6	0.1	1.00
1.67	142.	0.304	94019.	4966.	293.5	0.1	1.00
1.67	142.	0.304	94097.	5330.	293.5	0.2	1.00
1.67	142.	0.304	94223.	5214.	293.4	0.2	1.00
1.67	142.	0.304	94280.	5008.	293.4	0.3	1.00

Table H.2.12 Tap water flushing after Re = 5000 contamination tests at x_b = 0.3 % (file:flsh45c2.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	$\overline{T}_{T_r}$ (K)	$T_b - \overline{T}_{T_r}$ (K)	$\frac{F_{T_b}}{F_{T_r}}$
0.15	13.	-0.007	402.	293.2	0.5	1.00
0.15	13.	-0.007	453.	292.6	1.1	1.00
0.15	13.	-0.007	506.	292.0	1.7	1.00
0.15	13.	-0.007	557.	291.5	2.2	1.00
0.15	13.	-0.007	610.	291.0	2.7	1.00
0.15	13.	-0.007	663.	290.6	3.1	1.00
0.15	13.	-0.007	719.	290.1	3.6	1.01
0.15	13.	-0.007	775.	289.6	4.0	1.01
0.15	13.	-0.007	832.	289.2	4.5	1.01
0.15	13.	-0.007	886.	288.9	4.8	1.01
0.15	13.	-0.007	938.	288.7	5.0	1.01
0.15	13.	-0.007	995.	288.5	5.2	1.01
0.15	13.	-0.007	1053.	288.3	5.4	1.01
0.03	3.	0.007	3736.	286.4	7.3	1.01
0.03	3.	0.007	3787.	286.4	7.3	1.01
0.03	3.	0.007	3842.	286.4	7.3	1.01
0.03	3.	0.007	3902.	286.4	7.3	1.01
0.03	3.	0.007	3958.	286.4	7.3	1.01
0.03	3.	0.007	4013.	286.4	7.3	1.01
0.03	3.	0.007	4070.	286.4	7.3	1.01
0.03	3.	0.007	4124.	286.4	7.3	1.01
0.03	3.	0.007	4180.	286.4	7.3	1.01
0.03	3.	0.007	4234.	286.4	7.3	1.01
0.03	3.	0.007	4294.	286.4	7.3	1.01
0.03	3.	0.007	4349.	286.4	7.3	1.01
0.03	3.	0.007	4406.	286.4	7.3	1.01
-0.40	-34.	-0.004	64014.	287.3	6.4	1.01
-0.40	-34.	-0.004	64064.	287.3	6.3	1.01
-0.40	-34.	-0.004	64118.	287.3	6.3	1.01
-0.40	-34.	-0.004	64176.	287.3	6.4	1.01
-0.40	-34.	-0.004	64239.	287.3	6.4	1.01
-0.40	-34.	-0.004	64292.	287.3	6.3	1.01
-0.40	-34.	-0.004	64346.	287.3	6.4	1.01
-0.40	-34.	-0.004	64398.	287.3	6.3	1.01
-0.40	-34.	-0.004	64452.	287.3	6.4	1.01
-0.40	-34.	-0.004	64508.	287.3	6.3	1.01
-0.40	-34.	-0.004	64560.	287.3	6.3	1.01
-0.40	-34.	-0.004	64612.	287.3	6.3	1.01
-0.40	-34.	-0.004	64667.	287.3	6.3	1.01
-0.19	-16.	-0.003	64866.	287.3	6.3	1.01
-0.19	-16.	-0.003	64920.	287.3	6.3	1.01
-0.19	-16.	-0.003	64975.	287.3	6.3	1.01
-0.19	-16.	-0.003	65027.	287.3	6.3	1.01
-0.19	-16.	-0.003	65082.	287.3	6.3	1.01
-0.19	-16.	-0.003	65135.	287.3	6.3	1.01
-0.19	-16.	-0.003	65188.	287.3	6.3	1.01
-0.19	-16.	-0.003	65245.	287.3	6.3	1.01
-0.19	-16.	-0.003	65300.	287.3	6.3	1.01
-0.19	-16.	-0.003	65351.	287.3	6.3	1.01
-0.19	-16.	-0.003	65405.	287.3	6.3	1.01
-0.19	-16.	-0.003	65458.	287.3	6.3	1.01
-0.19	-16.	-0.003	65513.	287.3	6.3	1.01
-0.39	-34.	-0.004	67977.	287.5	6.2	1.01
-0.39	-34.	-0.004	68028.	287.5	6.2	1.01
-0.39	-34.	-0.004	68086.	287.5	6.2	1.01
-0.39	-34.	-0.004	68139.	287.5	6.2	1.01
-0.39	-34.	-0.004	68190.	287.5	6.2	1.01
-0.39	-34.	-0.004	68242.	287.5	6.2	1.01
-0.39	-34.	-0.004	68297.	287.5	6.2	1.01
-0.39	-34.	-0.004	68349.	287.5	6.2	1.01
-0.39	-34.	-0.004	68402.	287.5	6.2	1.01
-0.39	-34.	-0.004	68453.	287.5	6.2	1.01
-0.39	-34.	-0.004	68504.	287.5	6.2	1.01
-0.39	-34.	-0.004	68556.	287.5	6.2	1.01
-0.39	-34.	-0.004	68610.	287.5	6.2	1.01
-0.31	-26.	-0.001	71528.	286.8	6.9	1.01
-0.31	-26.	-0.001	71580.	286.8	6.9	1.01
-0.31	-26.	-0.001	71634.	286.8	6.9	1.01
-0.31	-26.	-0.001	71682.	286.8	6.9	1.01
-0.31	-26.	-0.001	71733.	286.8	6.9	1.01
-0.31	-26.	-0.001	71783.	286.7	6.9	1.01
-0.31	-26.	-0.001	71837.	286.7	6.9	1.01
-0.31	-26.	-0.001	71891.	286.7	7.0	1.01
-0.31	-26.	-0.001	71942.	286.7	7.0	1.01
-0.31	-26.	-0.001	71992.	286.7	7.0	1.01
-0.31	-26.	-0.001	72043.	286.7	7.0	1.01
-0.31	-26.	-0.001	72097.	286.7	7.0	1.01
-0.31	-26.	-0.001	72148.	286.6	7.0	1.01
-0.20	-17.	0.003	72616.	286.4	7.3	1.01
-0.20	-17.	0.003	72666.	286.4	7.3	1.01
-0.20	-17.	0.003	72718.	286.3	7.3	1.01
-0.20	-17.	0.003	72770.	286.3	7.4	1.01
-0.20	-17.	0.003	72820.	286.3	7.4	1.01
-0.20	-17.	0.003	72873.	286.3	7.4	1.01
-0.20	-17.	0.003	72925.	286.2	7.4	1.01
-0.20	-17.	0.003	72975.	286.2	7.5	1.01
-0.20	-17.	0.003	73028.	286.2	7.5	1.01
-0.20	-17.	0.003	73077.	286.2	7.5	1.01
-0.20	-17.	0.003	73127.	286.2	7.5	1.01
-0.20	-17.	0.003	73179.	286.2	7.5	1.01
-0.20	-17.	0.003	73234.	286.2	7.5	1.01
-0.26	-23.	0.001	73429.	286.2	7.5	1.01
-0.26	-23.	0.001	73488.	286.2	7.5	1.01
-0.26	-23.	0.001	73548.	286.2	7.5	1.01
-0.26	-23.	0.001	73605.	286.2	7.5	1.01
-0.26	-23.	0.001	73658.	286.2	7.5	1.01
-0.26	-23.	0.001	73711.	286.2	7.5	1.01
-0.26	-23.	0.001	73763.	286.2	7.5	1.01
-0.26	-23.	0.001	73816.	286.2	7.5	1.01
-0.26	-23.	0.001	73870.	286.2	7.5	1.01
-0.26	-23.	0.001	73926.	286.2	7.4	1.01
-0.26	-23.	0.001	73977.	286.2	7.5	1.01
-0.26	-23.	0.001	74036.	286.2	7.4	1.01
-0.26	-23.	0.001	74092.	286.2	7.4	1.01
-0.30	-26.	-0.002	77386.	286.3	7.4	1.01
-0.30	-26.	-0.002	77439.	286.3	7.4	1.01
-0.30	-26.	-0.002	77493.	286.3	7.4	1.01
-0.30	-26.	-0.002	77544.	286.3	7.4	1.01
-0.30	-26.	-0.002	77595.	286.3	7.4	1.01
-0.30	-26.	-0.002	77648.	286.2	7.4	1.01
-0.30	-26.	-0.002	77702.	286.2	7.4	1.01
-0.30	-26.	-0.002	77752.	286.2	7.5	1.01
-0.30	-26.	-0.002	77805.	286.2	7.5	1.01
-0.30	-26.	-0.002	77860.	286.2	7.5	1.01
-0.30	-26.	-0.002	77911.	286.1	7.5	1.01
-0.30	-26.	-0.002	77961.	286.1	7.5	1.01
-0.30	-26.	-0.002	78015.	286.1	7.6	1.01
-0.29	-25.	-0.005	81839.	286.3	7.4	1.01
-0.29	-25.	-0.005	81891.	286.3	7.4	1.01
-0.29	-25.	-0.005	81941.	286.3	7.4	1.01
-0.29	-25.	-0.005	81992.	286.3	7.3	1.01
-0.29	-25.	-0.005	82044.	286.3	7.3	1.01
-0.29	-25.	-0.005	82107.	286.3	7.3	1.01
-0.29	-25.	-0.005	82161.	286.3	7.3	1.01
-0.29	-25.	-0.005	82217.	286.3	7.3	1.01
-0.29	-25.	-0.005	82272.	286.3	7.3	1.01
-0.29	-25.	-0.005	82322.	286.3	7.3	1.01
-0.29	-25.	-0.005	82372.	286.3	7.3	1.01
-0.29	-25.	-0.005	82425.	286.3	7.3	1.01
-0.29	-25.	-0.005	82477.	286.3	7.3	1.01
-0.36	-31.	-0.002	86294.	286.5	7.2	1.01
-0.36	-31.	-0.002	86343.	286.4	7.2	1.01
-0.36	-31.	-0.002	86398.	286.4	7.3	1.01
-0.36	-31.	-0.002	86447.	286.4	7.2	1.01
-0.36	-31.	-0.002	86498.	286.4	7.3	1.01
-0.36	-31.	-0.002	86551.	286.4	7.2	1.01
-0.36	-31.	-0.002	86603.	286.4	7.2	1.01
-0.36	-31.	-0.002	86656.	286.4	7.3	1.01
-0.36	-31.	-0.002	86708.	286.4	7.3	1.01
-0.36	-31.	-0.002	86759.	286.4	7.3	1.01
-0.36	-31.	-0.002	86810.	286.4	7.3	1.01
-0.36	-31.	-0.002	86859.	286.4	7.3	1.01
-0.36	-31.	-0.002	86911.	286.4	7.3	1.01
-0.31	-26.	-0.004	87078.	286.3	7.3	1.01
-0.31	-26.	-0.004	87129.	286.3	7.4	1.01
-0.31	-26.	-0.004	87183.	286.3	7.4	1.01
-0.31	-26.	-0.004	87237.	286.3	7.4	1.01
-0.31	-26.	-0.004	87288.	286.3	7.4	1.01
-0.31	-26.	-0.004	87340.	286.2	7.4	1.01
-0.31	-26.	-0.004	87395.	286.2	7.5	1.01
-0.31	-26.	-0.004	87445.	286.3	7.4	1.01
-0.31	-26.	-0.004	87497.	286.2	7.4	1.01
-0.31	-26.	-0.004	87548.	286.2	7.4	1.01

Table H.2.13 Tap water flushing after Re = 7000 contamination tests at x_b = 0.3 % (file:flsh6c2.tb2)

l_e (μm)	Γ (kg/m^2) X10^5	x_b (%)	Exposure Time (s)	$\bar{T}_{T_r}$ (K)	$T_b - \bar{T}_{T_r}$ (K)	$\frac{F_{T_b}}{F_{T_r}}$
-0.54	-46.	0.003	0.	296.8	-3.1	1.00
-0.54	-46.	0.003	56.	296.0	-2.3	1.00
-0.54	-46.	0.003	110.	295.5	-1.8	1.00
-0.54	-46.	0.003	165.	294.9	-1.1	1.00
-0.54	-46.	0.003	218.	294.2	-0.5	1.00
-0.54	-46.	0.003	276.	293.5	0.1	1.00
-0.54	-46.	0.003	328.	292.9	0.8	1.00
-0.54	-46.	0.003	383.	291.9	1.7	1.00
-0.54	-46.	0.003	439.	290.8	2.9	1.00
-0.54	-46.	0.003	492.	289.9	3.8	1.01
-0.54	-46.	0.003	544.	289.1	4.6	1.01
-0.54	-46.	0.003	600.	288.4	5.3	1.01
-0.54	-46.	0.003	654.	287.9	5.8	1.01
-0.03	-2.	0.006	11606.	284.2	9.5	1.01
-0.03	-2.	0.006	11662.	284.2	9.5	1.01
-0.03	-2.	0.006	11753.	284.2	9.5	1.01
-0.03	-2.	0.006	11809.	284.2	9.5	1.01
-0.03	-2.	0.006	11862.	284.2	9.5	1.01
-0.03	-2.	0.006	11918.	284.2	9.5	1.01
-0.03	-2.	0.006	11974.	284.2	9.5	1.01
-0.03	-2.	0.006	12030.	284.2	9.5	1.01
-0.03	-2.	0.006	12091.	284.2	9.5	1.01
-0.03	-2.	0.006	12143.	284.2	9.5	1.01
-0.03	-2.	0.006	12197.	284.2	9.5	1.01
-0.03	-2.	0.006	12250.	284.2	9.5	1.01
-0.03	-2.	0.006	12305.	284.1	9.5	1.01
-0.17	-15.	0.005	15484.	283.7	10.0	1.02
-0.17	-15.	0.005	15541.	283.7	10.0	1.02
-0.17	-15.	0.005	15599.	283.7	10.0	1.02
-0.17	-15.	0.005	15652.	283.7	10.0	1.02
-0.17	-15.	0.005	15722.	283.7	10.0	1.02
-0.17	-15.	0.005	15778.	283.7	10.0	1.02
-0.17	-15.	0.005	15835.	283.7	10.0	1.02
-0.17	-15.	0.005	15890.	283.7	10.0	1.02
-0.17	-15.	0.005	15953.	283.7	10.0	1.02
-0.17	-15.	0.005	16008.	283.7	10.0	1.02
-0.17	-15.	0.005	16065.	283.7	10.0	1.02
-0.17	-15.	0.005	16120.	283.7	10.0	1.02
-0.17	-15.	0.005	16191.	283.7	10.0	1.02
-0.45	-39.	0.000	77260.	285.3	8.4	1.01
-0.45	-39.	0.000	77315.	285.3	8.4	1.01
-0.45	-39.	0.000	77369.	285.3	8.4	1.01
-0.45	-39.	0.000	77421.	285.3	8.4	1.01
-0.45	-39.	0.000	77475.	285.3	8.4	1.01
-0.45	-39.	0.000	77526.	285.3	8.4	1.01
-0.45	-39.	0.000	77580.	285.3	8.4	1.01
-0.45	-39.	0.000	77632.	285.3	8.4	1.01
-0.45	-39.	0.000	77682.	285.3	8.4	1.01
-0.45	-39.	0.000	77735.	285.3	8.4	1.01
-0.45	-39.	0.000	77789.	285.3	8.4	1.01
-0.45	-39.	0.000	77841.	285.3	8.4	1.01
-0.45	-39.	0.000	77895.	285.3	8.4	1.01
-0.58	-50.	-0.009	78063.	285.3	8.4	1.01
-0.58	-50.	-0.009	78114.	285.3	8.4	1.01
-0.58	-50.	-0.009	78168.	285.2	8.4	1.01
-0.58	-50.	-0.009	78219.	285.2	8.5	1.01
-0.58	-50.	-0.009	78274.	285.2	8.5	1.01
-0.58	-50.	-0.009	78327.	285.2	8.5	1.01
-0.58	-50.	-0.009	78381.	285.2	8.5	1.01
-0.58	-50.	-0.009	78433.	285.2	8.5	1.01
-0.58	-50.	-0.009	78485.	285.2	8.5	1.01
-0.58	-50.	-0.009	78539.	285.2	8.5	1.01
-0.58	-50.	-0.009	78593.	285.2	8.5	1.01
-0.58	-50.	-0.009	78647.	285.2	8.5	1.01
-0.58	-50.	-0.009	78701.	285.2	8.5	1.01
-0.66	-56.	-0.013	82130.	285.0	8.7	1.01
-0.66	-56.	-0.013	82181.	285.0	8.8	1.01
-0.66	-56.	-0.013	82238.	285.0	8.7	1.01
-0.66	-56.	-0.013	82292.	284.9	8.8	1.01
-0.66	-56.	-0.013	82350.	284.9	8.8	1.01
-0.66	-56.	-0.013	82404.	284.9	8.8	1.01
-0.66	-56.	-0.013	82457.	284.9	8.8	1.01
-0.66	-56.	-0.013	82512.	284.9	8.8	1.01
-0.66	-56.	-0.013	82565.	284.9	8.8	1.01
-0.66	-56.	-0.013	82616.	284.9	8.8	1.01
-0.66	-56.	-0.013	82670.	284.9	8.8	1.01
-0.66	-56.	-0.013	82723.	284.9	8.8	1.01
-0.66	-56.	-0.013	82774.	284.9	8.8	1.01
-0.58	-50.	-0.005	86376.	284.1	9.6	1.01
-0.58	-50.	-0.005	86430.	284.1	9.6	1.01
-0.58	-50.	-0.005	86481.	284.1	9.6	1.01
-0.58	-50.	-0.005	86533.	284.2	9.5	1.01
-0.58	-50.	-0.005	86587.	284.2	9.5	1.01
-0.58	-50.	-0.005	86642.	284.1	9.5	1.01
-0.58	-50.	-0.005	86701.	284.2	9.5	1.01
-0.58	-50.	-0.005	86757.	284.2	9.5	1.01
-0.58	-50.	-0.005	86811.	284.2	9.5	1.01
-0.58	-50.	-0.005	86865.	284.2	9.5	1.01
-0.58	-50.	-0.005	86918.	284.2	9.5	1.01
-0.58	-50.	-0.005	86972.	284.1	9.5	1.01
-0.58	-50.	-0.005	87025.	284.2	9.5	1.01
-0.56	-48.	-0.007	87172.	284.1	9.6	1.01
-0.56	-48.	-0.007	87225.	284.1	9.5	1.01
-0.56	-48.	-0.007	87278.	284.1	9.6	1.01
-0.56	-48.	-0.007	87335.	284.1	9.6	1.02
-0.56	-48.	-0.007	87400.	284.1	9.6	1.01
-0.56	-48.	-0.007	87456.	284.1	9.6	1.01
-0.56	-48.	-0.007	87513.	284.1	9.6	1.01
-0.56	-48.	-0.007	87565.	284.1	9.6	1.01
-0.56	-48.	-0.007	87621.	284.1	9.6	1.02
-0.56	-48.	-0.007	87672.	284.1	9.6	1.02
-0.56	-48.	-0.007	87727.	284.1	9.6	1.02
-0.56	-48.	-0.007	87780.	284.1	9.6	1.02
-0.56	-48.	-0.007	87832.	284.1	9.6	1.02
-0.50	-43.	-0.003	87988.	284.1	9.6	1.02
-0.50	-43.	-0.003	88044.	284.1	9.6	1.02
-0.50	-43.	-0.003	88098.	284.0	9.7	1.02
-0.50	-43.	-0.003	88154.	284.0	9.7	1.02
-0.50	-43.	-0.003	88207.	284.0	9.7	1.02
-0.50	-43.	-0.003	88265.	284.1	9.6	1.02
-0.50	-43.	-0.003	88318.	284.1	9.6	1.02
-0.50	-43.	-0.003	88371.	284.0	9.6	1.02
-0.50	-43.	-0.003	88426.	284.0	9.7	1.02
-0.50	-43.	-0.003	88480.	284.0	9.7	1.02
-0.50	-43.	-0.003	88538.	284.0	9.6	1.02
-0.50	-43.	-0.003	88593.	284.0	9.7	1.02
-0.50	-43.	-0.003	88648.	284.0	9.7	1.02
-0.66	-57.	-0.011	95135.	284.2	9.6	1.01
-0.66	-57.	-0.011	95191.	284.2	9.6	1.01
-0.66	-57.	-0.011	95245.	284.2	9.5	1.01
-0.66	-57.	-0.011	95298.	284.2	9.5	1.01
-0.66	-57.	-0.011	95357.	284.2	9.5	1.01
-0.66	-57.	-0.011	95413.	284.2	9.5	1.01
-0.66	-57.	-0.011	95472.	284.2	9.4	1.01
-0.66	-57.	-0.011	95529.	284.2	9.4	1.01
-0.66	-57.	-0.011	95584.	284.3	9.4	1.01
-0.66	-57.	-0.011	95635.	284.3	9.4	1.01
-0.66	-57.	-0.011	95691.	284.3	9.4	1.01
-0.66	-57.	-0.011	95746.	284.3	9.4	1.01
-0.66	-57.	-0.011	95801.	284.3	9.4	1.01
-0.52	-44.	-0.011	100071.	284.3	9.4	1.01
-0.52	-44.	-0.011	100129.	284.3	9.4	1.01
-0.52	-44.	-0.011	100183.	284.3	9.4	1.01
-0.52	-44.	-0.011	100237.	284.3	9.4	1.01
-0.52	-44.	-0.011	100290.	284.3	9.4	1.01
-0.52	-44.	-0.011	100344.	284.2	9.4	1.01
-0.52	-44.	-0.011	100398.	284.3	9.4	1.01
-0.52	-44.	-0.011	100453.	284.2	9.4	1.01
-0.52	-44.	-0.011	100515.	284.2	9.5	1.01
-0.52	-44.	-0.011	100575.	284.2	9.5	1.01
-0.52	-44.	-0.011	100631.	284.1	9.6	1.01
-0.52	-44.	-0.011	100689.	284.1	9.5	1.01
-0.52	-44.	-0.011	100744.	284.2	9.5	1.01
-0.71	-61.	-0.010	166191.	285.9	7.8	1.01
-0.71	-61.	-0.010	166248.	285.8	7.8	1.01
-0.71	-61.	-0.010	166302.	285.9	7.8	1.01
-0.71	-61.	-0.010	166356.	285.9	7.8	1.01
-0.71	-61.	-0.010	166410.	285.9	7.8	1.01
-0.71	-61.	-0.010	166464.	285.9	7.8	1.01
-0.71	-61.	-0.010	166518.	285.9	7.8	1.01
-0.71	-61.	-0.010	166574.	285.9	7.8	1.01
-0.71	-61.	-0.010	166626.	285.9	7.8	1.01
-0.71	-61.	-0.010	166676.	285.9	7.8	1.01
-0.71	-61.	-0.010	166727.	285.9	7.8	1.01
-0.71	-61.	-0.010	166779.	285.9	7.8	1.01
-0.71	-61.	-0.010	166832.	285.9	7.8	1.01
-0.56	-48.	-0.007	168424.	285.4	8.3	1.01

APPENDIX I: SPECTROFLUOROMETER CHECK

This appendix discusses how the emission and excitation wavelength measurements were verified with a mercury standard and a "crossover peak" from the excitation. The emission wavelength measurement obtained from the spectrofluorometer without the glass filter was checked against a mercury vapor light. Figure I.1 and Table I.1 show a comparison of the published values of the peak wavelengths for mercury (Reader et al., 1980) to those obtained from the spectrofluorometer. The absolute difference between the measured and published wavelengths was approximately within 10 nm.

The excitation wavelength measurement obtained from the spectrofluorometer was checked with a "crossover peak" from the excitation. In other words, the excitation monochromator was set to a specific wavelength with no specimen in the sample chamber. Under these conditions, the emission intensity should peak at the excitation wavelength. The wavelength of the emission peaked at the excitation wavelength to within the resolution of the digital display (± 1 nm) for the wavelengths that were tested.

Table I.1 Calibration check of spectrofluorometer against Mercury lamp

Published[1] wavelength (nm)	Measured wavelength (nm)	Absolute difference (nm)	Relative Difference (%)
312.567	307	5	1.6
365.015	358	7	1.9
404.656	398	7	1.7
435.833	427	9	2.1
546.074	540	6	1.1
576.960	569	8	1.4

[1]Reader et al. (1980)

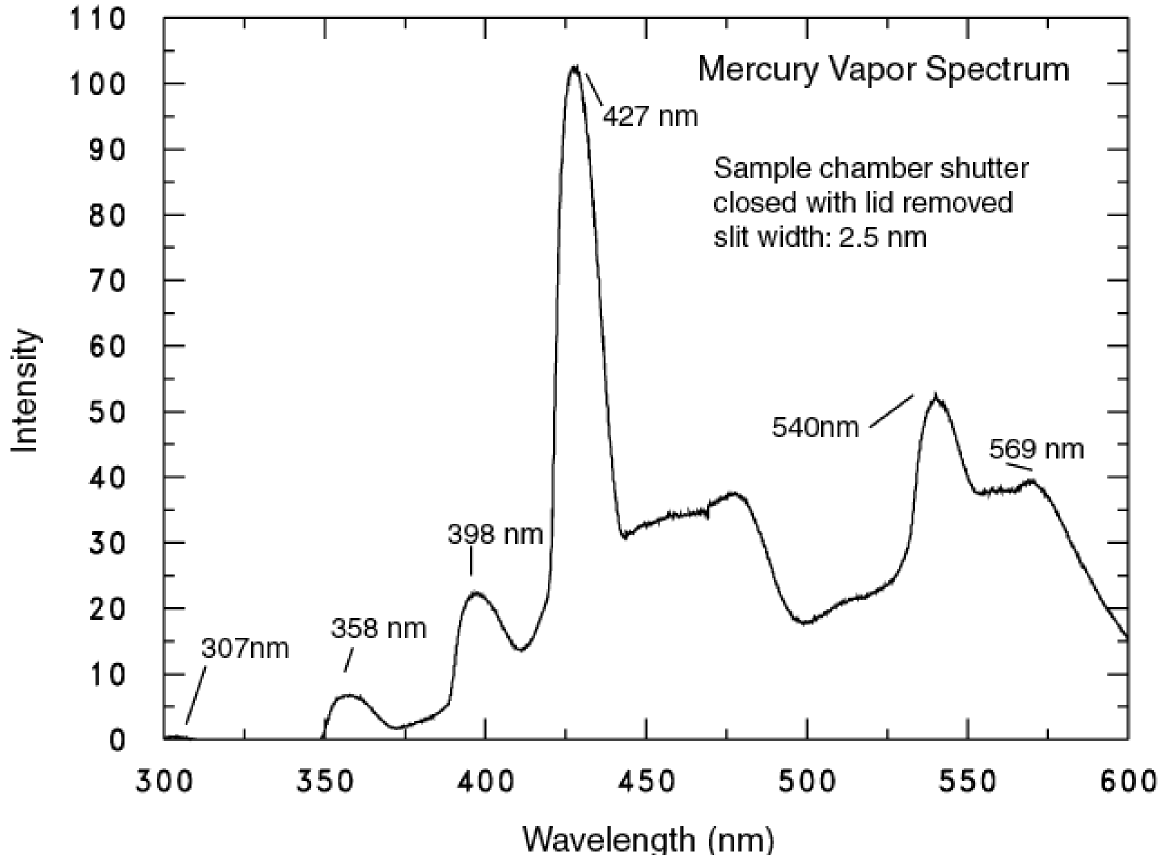

Fig. I.1 Verification of spectrofluorometer wavelength with Mercury standard