# Thermal characterization of hydrocarbon-water interfaces

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The interest in systems containing mixtures of non-miscible liquids makes them important, among others, the study of heat transport at their interfaces. Although there are many studies on interfaces solid-solid and liquid-liquid, very few studies have been focused on liquid-liquid interfaces [1]. The knowledge of the behavior of thermal properties in these soft interfaces is important to understand heat transfer mechanisms in systems such as cellular environments, oil fields, some solvents, etc. In this work, the thermo-optical technique of transient thermal lens [2] was used to monitor the behavior of characteristic parameters along the direction normal to the interface between water and some n-alkanes described by the formula $C_N H_{2N+2}$, with $N = 5 - 8$, including isooctane. In that technique, a laser beam (pump or excitation) is focused on a point of the sample. The radiation energy is partially absorbed and transformed into heat, generating a local gradient in the refractive index that acts as a thermal lens modifying the intensity of another laser beam (test or probe) that travels the excitation region. The temporal evolution of this intensity during excitation is measured in the far field with a photodetector in front of which a small hole is placed to only let pass a portion of the test beam. Ensuring that the initial and boundary conditions of a model developed for very low optical absorption samples are experimentally met [2] a data fit is made with that model to determine the thermal diffusivity and the parameter

$$\theta = -\frac{P_{in}\beta\ell_0}{k\lambda_p}\frac{dn}{dT} \qquad \text{Eqn. 1}$$

which depends on its thermal conductivity ($k$), the optical absorption coefficient ($\beta$), the thickness of the sample ($l_0$), the temperature coefficient of the refractive index ($dn/dT$), the pump beam power ($P_{in}$), and the wavelength of the probe beam ($\lambda$). Preliminary measurements suggest a behavior of some characteristic parameters, such as thermal diffusivity, around the interface, which qualitatively matches previously literature reports for the thermal lens signal in solid-solid interfaces [3], as shown in Fig. 1.

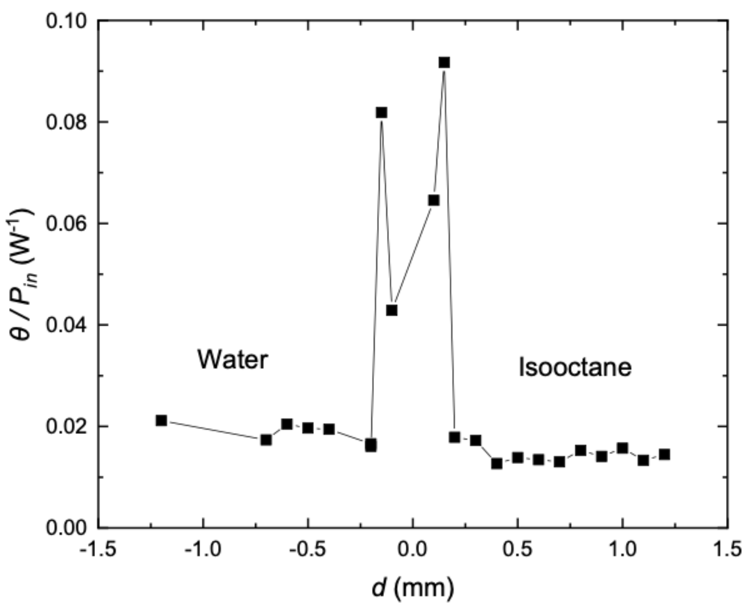


**Fig. 1.** Parameter $\theta$ normalized to the pump beam power used for each measurement, as a function of the distance ($d$) perpendicular to the interface, which is located at $d$ = 0.0 mm.

Using the estimated interfacial thermal diffusivity, the interface thickness and typical value of the heat capacity per unit volume reported for condensed matter [4], it was possible to calculate the interfacial thermal resistance value.

## References


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