Physical Chemistry

DETERMINATION OF THE DIFFUSION COEFFICIENT AT A GLYCERIN/WATER INTERFACE BY IMAGING PYRENE FLUORESCENCE WITH A DIGITAL CAMERA

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We are currently performing experiments to determine the diffusion coefficient of glycerin and water using a fluorescence technique. This technique is a non-invasive method that could easily be recreated in an upper-division undergraduate physics or chemistry laboratory. Pyrene, a fluorescent probe, is mixed with glycerin and water. An interface between glycerin and water is produced in a cuvette and irradiated with 365nm light from a mercury lamp. The intensity of the fluorescence is dependant upon local viscosity and therefore concentration of glycerin and is easily seen as a variation in brightness of fluorescence. The glycerin/water interface is photographed with a digital camera over time as the glycerin and water inter-diffuse. The images are converted to matrices using MathCad (Product of Mathsoft Corp.). The pixel-averaged fluorescence as a function of distance from the initial interface is then fit to the infinite-boundary solution to the diffusion equation yielding the diffusion coefficient.