Infrared Soret forced Rayleigh scattering apparatus using a single crystal diamond window to measure Soret and mass diffusion coefficient

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The Soret effect describes a mass transport phenomenon driven by a temperature gradient, while the driving force of the mass diffusion is a concentration gradient. We have developed an experimental apparatus to measure Soret coefficient and mass diffusion coefficient in aqueous solutions based on the optical holographic grating technique which we call the infrared Soret forced Rayleigh scattering (IR-SFRS).

The IR-SFRS apparatus [1] is shown in Figure 1. Mass transport in a sample is induced by the heating laser with the wavelength of $\lambda = 9.7$ μm and observed by the probing laser of $\lambda = 639$ nm. By using an infrared laser, measurements without a dye can be performed, while the SFRS apparatus with visible light lasers [2,3] requires adding a dye to samples. A single crystal diamond window is used in a sample cell, because the incident side window should transmit both lasers.

To evaluate the validity of the apparatus, we performed experiments on aqueous ethanol solutions at a temperature of 298.2 K. The Soret coefficient and the mass diffusion coefficient were compared with the experimental works by other groups.

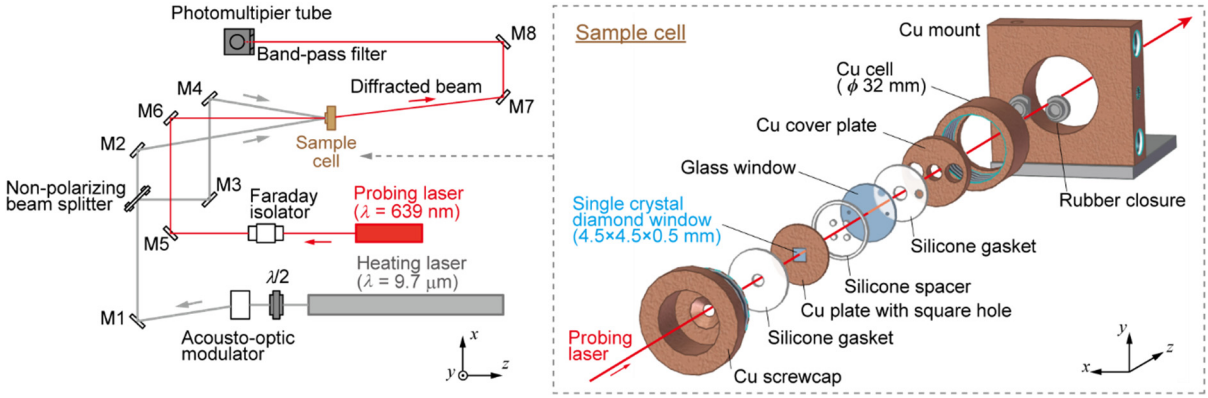

Figure 1: Optical system of the infrared Soret forced Rayleigh scattering (IR-SFRS).

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References

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