Interferometric Measurements of Binary Fluids

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Properties of binary fluids near their critical points have been measured using optical interference techniques. Focal plane interference and image plane interference have been used for this study. The interference measurements are carried out with a He-Ne laser Mach-Zender interferometer. One arm of the split laser beam passes through the cell containing the fluid sample under study and is recombined with a reference beam. The cell temperature is controlled to within 2×10^{-4}°C.

The refractive index profile of the fluid changes as the temperature is decreased from a starting temperature $T \lesssim T_C$.

The consequent change in the interference pattern is detected photographically and information on the critical behavior of the mixture is obtained from the relation between the interference fringe pattern variation and the temperature at which the variation occurred. The critical temperature is found first by focal plane interference films and by means of Renormalization Group theory results. The image plane interference fringe patterns are the basis for the study of other critical quantities as well as an aid to better determination of the critical temperature and verification of the RG results for the critical exponents themselves. Results obtained recently for the coexistence curve of the binary fluid heptane-nitrobenzene will be presented.