Critical Behavior of the Ultrasonic Attenuation for the Binary Mixture of Water – Phenol

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Abstract

The dynamic shear viscosity of the binary liquid mixture water – phenol was measured for different temperatures and concentrations using the glass capillary and digital viscometers. Dynamic shear viscosity anomaly was detected near the critical temperature T_c = 67 °C and the critical concentration x_c= 33.9% by weight of phenol. The specific heat at constant pressure was calculated using the two scale factor universality and found to be 241.9$\frac{J}{kg\ K}$. The critical and the background isobaric thermal expansion coefficients were determined and found to be 2.729 x10^{-3} °C^{-1} and 22.59 x10^{-3} °C^{-1} respectively. Ultrasonic attenuation data at 9, 15, 30 and 35 MHz were analyzed using the dynamic scaling theory of Ferrell and Bhattacharjee. The values of$\frac{\alpha_c}{f^2}$ versus $f^{-1.06}$ yield a straight line as predicted by the theory. The experimental values of $\frac{\alpha(x_c,T)}{\alpha_c(x_c,T_c)}$ for water – phenol were compared to the scaling function F(ω*') and showed good agreement with the theory.