STUDY OF THE TRANSPORT PROPERTIES OF THE CRITICAL BINARY MIXTURE TRIETHYLAMINE – WATER WITH AN IONIC IMPURITY

A. Toumi[1], *N. Hafaiedh*[1], *M. Bouanz*[2]

[1]Laboratoire de Physique des Liquides Critiques,
Département de Physique
Faculté des Sciences de Bizerte Zarzouna
7021 Bizerte Université de Carthage
TUNISIA
(*e-mail: Adel.Toumi@fst.rnu.tn*),
[2]Laboratoire de Physique des Liquides
et d'Optique Non Linéaire
Département de Physique,
Faculté des Sciences de Tunis
Campus universitaire, El Manar 2092 Tunis
Université de Tunis El Manar
TUNISIA

S u m m a r y

The binary liquid mixture of triethylamine + water (TEA–W) has a lower consolute point at a critical composition of 32.27 mass. % triethylamine. The shear viscosity (η) and the electrical conductivity (σ) in the single phase region of this system with added (K^+, Cl^-) ions at various concentrations are measured in the vicinity and far from the critical temperature T_C. For the pure system without KCl salt, the viscosity measurements yield an enhancement, as expected, for the Ising criticality with a crossover to a regular behavior. Shear viscosity data are consistent with a power-law divergence $\eta = \eta_0(Q\ \zeta_0)^z t^{-y}$ predicted by the mode-coupling and dynamic renormalization group theories. In the temperature range $\Delta T = T_C - T < 2$ °C, the electrical conductivity (σ) exhibits a monotonous deviation from the Vogel–Fulcher–Tammann (VFT) behavior. This anomaly is described by a power law $t^{1-\alpha}$, where t is the reduced temperature $\left|\frac{T-T_C}{T_C}\right|$, and α is the critical exponent of the specific heat anomaly at constant pressure. For the electrolyte mixtures, the obtained critical exponent values are in the range of those expected by the theoretical calculations for the Ising 3D universality class. By combining the viscosity and the electrical conductivity data, the value of the computed Walden product has been determined, and the salt dissociation degrees, as well as the Debye screening length, have been estimated.