Molecular Association of Tetramethylurea and Chlorobenzene Molecules in Microwave Frequency Range

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The dielectric constant ε' and dielectric loss ε'' of the binary mixtures of tetramethylurea (TMU) and chlorobenzene (CB) have been calculated at 9.883 GHz by using standard standing microwave techniques. Gopalakrishna's single frequency concentration variation method has been used to calculate dipole moment μ and dielectric relaxation time τ for different mole fractions of TMU in the binary mixture at different temperatures of 25 °C, 30 °C, 35 °C, and 40 °C. The variation of dielectric relaxation time with the mole fraction of TMU in the whole concentration range of the binary mixtures was found to be non-monotonic. The solute-solute and solute-solvent type of molecular associations may be proposed based upon above observations. Using Eyring rate equations the energy parameters ΔH, ΔF, and ΔS for the dielectric relaxation process and the viscous flow process have been calculated at the given temperatures. It is found from the comparison of energy parameters that, just like the viscous flow process, the dielectric relaxation process can also be treated as a rate process.

Key words: Tetramethylurea (TMU); Chlorobenzene (CB); Binary Mixture; Microwave Absorption; Dielectric Relaxation.