Appunti di Fisica '15
&
Dottorato di Ricerca in Fisica

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Sala seminari, CNR-IPCF

Some considerations on confined water: the thermal behavior of transport properties in water-glycerol and water methanol mixtures

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We discuss recent and literature data on the relaxation times (the primary τ_α), viscosity and self-diffusion in water-glycerol mixtures in a wide temperature interval from the stable water phase to the deep supercooled regime (373 – 200K). In particular, we have studied the mixture in terms of the water molar fraction (X) by exploring the entire composition range at fixed temperatures with steps of 5K.

In such a way we observe a marked deviation from the ideal thermodynamic behavior of the transport functions. A deviation that is strongly T and X dependent spanning values that range from two orders of magnitude at the highest temperature to more than five in the deep supercooled regime (more precisely at about 200K).

The analysis of these deviations, in terms of the difference from the measured values and the ideal ones, reveals the dominant role of the hydrogen-bonding water network in the system properties up to X = 0.3.

Furthermore, an Arrhenius plot of the maximum excess value ($\Delta\tau_\alpha(T)$ v.s. 1/T) reveals linear behaviors with two significant slope changes: one at the dynamical crossover temperature (T_L~225K, i.e. the locus of the Widom line); and one at T~315K (the temperature of the minimum of the water isothermal compressibility, χ_T.

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