Water @ deep negative pressure – high isotropic tension : structure & dynamics

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Condensed matter -solids or liquids, but not gases - might be deeply, homogeneously stretched to absolute negative pressures (metastable regimes of isotropic tension). [1]For instance, we were able to stretch macroscopically-sized liquid solutions down to p = - 35 MPa,[2] a value which still constitutes a world record for large volume liquid samples. Up to now, this record is hold for neat liquid water in microscopic porous crevices of natural rocks, p = -140 MPa.

Negative pressures can be either directly measured – *via* a highly elaborated Bourdon-Berthelot combination methodology [1-4] – or safely estimated through the liquid's isochoric thermal-pressure coefficient, $\gamma_v = \alpha_p/\kappa_T$. NMR studies have been performed on water and salty (ionic liquids) aqueous solutions under isotropic tension. Upon entering into these metastable regimes of negative pressure, we observe a sharp increase in the ions' self-diffusion coefficients as compared to those of the equilibrium saturated liquid at the same temperatures.

Molecular dynamics (MD) studies have complemented the experimental ones to provide us with insights into the structure of these systems under these *T*,*p* conditions.

These unique studies have impacted our understanding of a wide range of Nature's phenomena, and, they have specially shown in the case of aqueous solutions how important the properties of metastable liquids are for the survival of living organisms and systems.

References:

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