

MAR13-2012-001480

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Solute effects on the thermodynamic and kinetic behavior of water and liquid-liquid transition¹

HAJIME TANAKA, Institute of Industrial Science, University of Tokyo

Water is known to be an exceptionally poor glass former, which is one of the characteristic features of water, but its link to the thermodynamic and kinetic anomalies of water remains elusive. Recently we showed that the glass-forming ability and the fragility of a water/salt mixture are closely related to its equilibrium phase diagram.² We proposed that frustration between local and global orderings controls both the glass-forming ability and fragility on the basis of experimental evidence. Relying on the same role of salt and pressure, which commonly breaks tetrahedral order, we apply this idea to pure water under pressure. This scenario not only explains unusual behavior of water-type liquids such as water, Si and Ge, but also provides a general explanation on the link between the equilibrium phase diagram, the glass-forming ability, and the fragility of various materials including oxides, chalcogenides, and metallic glasses.³ We also discuss liquid-liquid transition found in mixtures of water with glycerol⁴ and other molecules and its implications.

¹This work is collaboration with Ken-ichiro Murata and Mika Kobayashi.

²M. Kobayashi and H. Tanaka, Phys. Rev. Lett. **106**, 125703 (2011); J. Phys. Chem. B **115**, 14077 (2011)

³H. Tanaka, Eur. Phys. J. E **35**, 113 (2012)

⁴K. Murata and H. Tanaka, Nature Mater. **11**, 436 (2012)