

Proposed Microlattice Structures for High/Very High Density Amorphous Ice and the Exclusion Zone

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Three "amorphous" ices have been known for many years on which hundreds of experiments have been done: high density amorphous ice (HDA), low density amorphous ice (LDA), and very high density amorphous ice (VHDA). It is unknown whether they are glasses with no long range order beyond a few molecules versus consisting of microlattice, i.e. a mosaic of microdomains with various sizes and orientations, of an unknown phase of water. HDA and VHDA are unusual in that their oxygen coordination numbers are 5 and 6 respectively, whereas LDA has coordination 4 like familiar tetrahedral ices. This talk introduces hexagonal bilayer water (HBW) and pleated sheet water (PSW), two new phases of water that match extremely well the experimental properties of HDA and VHDA respectively. The hypothesis is explored that these are the microlattice structures for HDA and VHDA. Although HDA and VHDA crystallize to Ice-Ic if warmed at ambient pressure above 150 K, HBW and PSW are predicted to have high entropy compared to other water phases so they might also occur as relatively long-lived nanoscale components in liquid water at ambient temperature. If the Exclusion Zone were comprised of a combination of HBW and PSW, this might explain its unusual properties.