Topic 3190
Water; Molar Volume

The molar volume \( V^*(\ell) \) and density \( \rho^*(\ell) \) of water (\( \ell \)) are intensive properties. The \( p-V-T \) properties of water are perhaps the most extensively studied. Two properties are almost universally known; (i) the molar volume of water at ambient pressure and 273.15 K is less than that of ice, and (ii) the molar volume of water at 273.15 K decreases on heating to reach a TMD before increasing. At ambient pressure the temperature of maximum density for water, TMD = 3.98 Celsius; for D\(_2\)O, TMD = 11.44 Celsius. The TMD for SiO\(_2\) is around 15270 Celsius, the dependence of density on temperature being less marked about the TMD than that for water [1].

The dependence of \( V^*(H_2O;\ell) \) on temperature and pressure is reported by many laboratories. Most accounts cite the study reported by Kell and Whalley in 1965, later extended in 1978 [2,3]. Kell has examined the results in detail [4]. The TMD has, of course, attracted considerable attention. Nevertheless the TMD has no deep significance in the context of understanding the properties of water (\( \ell \)). Other properties of water (\( \ell \)) show extrema at other temperatures; e.g. isothermal compressibility near 300 K [5-7].

Footnotes