Influence of Impurities on the Speed of Sound of Water

Stephan Kabelac [C, S] and Mareike Wellmeier
Institute for Thermodynamics, Helmut-Schmidt University Hamburg, Hamburg, Germany

The speed of sound is among those thermodynamic properties of liquids which are very sensitive to impurities. Dissolved gases are especially influential. Using an apparatus which is capable of measuring the speed of sound in a liquid with high accuracy we systematically resolve the dependency of the speed of water on dissolved gases and salts. The apparatus uses a pulse-echo technique, the measurement uncertainties are estimated to be less than 3 mK for the temperature, 0.01 % for the pressure, and 0.03 % for the speed of sound. The temperature range of the apparatus is between 240 K and 420 K with pressures up to 100 MPa. The apparatus and its validation will be given a brief description. The available data on the speed of pure water, including our own, will be discussed and compared to equations of state. The composition of the water was systematically modified with dissolved air, dissolved carbon dioxide and dissolved salts. The influence of these impurities on the speed of sound of water in the liquid and supercritical state is discussed.

[1] K.Meier, S. Kabelac: Speed of sound instrument for fluids with pressures up to 100 MPa. Rev.Sci.Instrum., 77(2006) 123903.