

New Data for the Ionisation Constant of Water at High Temperatures and Pressures from Direct Conductivity Measurements

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Experimental values for the ionisation constant of water have been recently reported between 373 K and 674 K [1], based on direct measurements of the electrical conductivity of very pure water using high-precision high-temperature flow-through AC electrical conductance instruments based on the design by Wood and co-workers [2]. The new conductivity data expand the literature database and address a data gap at near-critical and supercritical conditions for densities between 0.50 g cm⁻³ and 0.20 g cm⁻³. The results compare well with published high-temperature potentiometric and calorimetric studies up to 573 K and are consistent with the 1981 and 2006 IAPWS (International Association for the Properties of Water and Steam) formulations to within better than 0.2 pK units up to 623 K. Above 623 K, both IAPWS formulations showed systematic deviations from the new results, which become significant near the critical point. This presentation will present the conductivity results and the methodology used to derive the water ionisation constants and will discuss the new results.

References

[1] H. Arcis, J.P. Ferguson, J.S. Cox, P.R. Tremaine, The Ionization Constant of Water at Elevated Temperatures and Pressures: New Data from Direct Conductivity Measurements and Revised Formulations from T = 273 K to 674 K and p = 0.1 MPa to 31 MPa. *J. Phys. Chem. Ref. Data* 2020 (doi: 10.1063/1.5127662)

[2] G. H. Zimmerman, M. S. Gruskiewicz, R. H. Wood, New Apparatus for Conductance Measurements at High Temperatures: Conductance of Aqueous Solutions of LiCl, NaCl, NaBr, and CsBr at 28 MPa and Water Densities from 700 to 260 kg m⁻³, *J. Phys. Chem.* 99 (1995), 11612-11625