Calorimetric Determination of the Standard State Thermodynamic Properties for Completely Dissociated Aqueous Hydrochloric Acid and Sodium Hydroxide up to 623 K

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The standard state partial molal thermodynamic properties for completely dissociated hydrochloric acid from 298 K to 623 K and at saturation pressure of water [1] were determined from ionic additivity of the data from other strong electrolytes, perrhenic acid [1,2], sodium perrhenate [1,2,3], and sodium chloride [1,4,5] at very high dilutions (10^{-4} m). From these standard state thermodynamic properties of hydrochloric acid, and other auxiliary data from literature, the standard electrode potential for Ag/AgCl electrode system and the equilibrium constants for the volatility of HCl from aqueous solutions were calculated and the results were compared with the literature data [6,7,8,9,10]. The standard state partial molal thermodynamic properties for completely dissociated aqueous sodium hydroxide were also calculated by ionic additivity over the same temperature range from aqueous sodium chloride, hydrochloric acid, and the dissociation constants of water from hydrogen electrode measurements [11] and the results were compared with the literature data [12,13].

[1] E. Djamali, *Ph.D. Dissertation*, University of California, San Diego and San Diego State University, (2005).
[2] J.C. Ahluwalia, and J.W. Cobble, *J. Am. Chem. Soc.* **86**, 5377 (1964).
[3] K. Chen, *Ph.D. Dissertation,* University of California, San Diego and San Diego State University, (1987).
[4] C.M. Criss, and J.W. Cobble, *J. Am. Chem. Soc.* **83**, 3223 (1961).
[5] W.L. Gardner, R.E. Mitchell, and J.W. Cobble, *J. Phys. Chem.* **73**, 2025 (1969).
[6] R.G. Bates, and V.E. Bower, *J. Res. Natl. Bur. Std.* **53**, 283 (1954).
[7] R.S. Greeley, W.T. Smith, Jr, R.W. Stoughton, and M.H. Lietzke, *J. Phys. Chem.* **64**, 652 (1960).
[8] R.S. Greeley, W.T. Smith, Jr, M.H. Lietzke, and R.W. Stoughton, *J. Phys. Chem.* **64**, 1445 (1960).
[9] J.J. Fritz and C.R. Fuget, *J. Chem. Eng. Data* **26**, 363 (1956).
[10] J.M. Simonson, and D.A. Palmer, *Geochim. Cosmochim. Acta* 57, **1** (1993).
[11] W.L. Marshall, and E.U. Franck, *J. Phys. Chem. Ref. Data* **10**, 295 (1981).
[12] G. Conti, P. Gianni, A. Papini, and E. Matteoli, *J. Solution Chem.* **17**, 481 (1988).
[13] J.M. Simonson, R.E. Mesmer, and P.S.Z. Rogers, *J. Chem. Thermo.* **21**, 561 (1989).