Transactions of the Faraday Society 1946 vol.42, pages 69-77

The thermodynamics of strontium

Kapustinsky A., Dezideryeva I.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

1. Measurements of heats of solution of strontium carbonate in hydrochloric acid were carried out which make it possible to determine the heats of reaction: SrO(s)+CO2(g)=SrCO3(s) ΔH 298=-290,887 cal. Sr(s)+C(gr)+3/2O 2(g)=SrCO3(s) ΔH298=-56,057 cal. Sr(s)+2H+=Sr+++H2(g) ΔH 298=-130,214 cal. and the entropy of the aqueous strontium ion. S298=-6.3 e.u. 2. The solubility of strontium carbonate in water at 25° C. (0.52×10-4 mol/l.) determined by the electrical conductivity method, and the heat capacities of aqueous solutions of strontium chloride at the same temperature in the concentration range 4.5%-14%, were determined. On the basis of the data obtained there were computed: the free energy of solution of strontianite in water ΔF=11,688 cal., the solubility product Lp=2.71×10-9; the electrode potential of strontium: Sr(s)=Sr+++2θ E0=-2.9 volts (which is in agreement with the former theoretical value given by Latimer). The linear dependence of the apparent heat capacity of a salt upon the square root of the molality is corroborated and the apparent molal heat capacity of the strontium ion calculated Cp 0=-10.2. It is shown that the heat capacities of bivalent cations, strontium in their number, are inversely proportional to the ionic radii (a dependence previously established by Kapustinsky on theoretical grounds). 3. With the aid of heat of reaction, heat capacity and decomposition pressure data for the reagents, an equation is derived for the free energy of dissociation of strontianite at high temperatures: ΔF=-54,686.0+3.58×T ln T-0.00396×T 2-97,750×10-1+17.1×T, and the standard free energy of the reaction, computed: SrO(s)+CO2(g)=SrCO3(s) ΔF298=-44,185 cal. which is in agreement with an accuracy of up to 0.7% with the measurements of the absolute entropies of the reagents made by Anderson. The disagreement between the calorimetric and high temperature equilibria data may be considered as removed.

http://dx.doi.org/10.1039/TF9464200069