An experimental study of solubility and speciation of NdF_3 in F-bearing aqueous solutions

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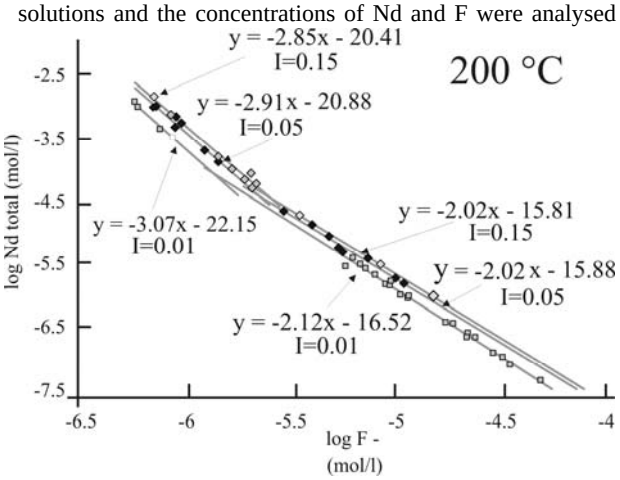
The solubility of neodymium fluoride was investigated at 150, 200 and 250 °C and saturated water vapour pressure. Experiments were performed in teflon test tubes sealed by teflon stoppers and placed in the autoclaves. In order to prevent failure of the test tubes due to the internal pressure developed during runs, an aliquot of distilled water was introduced into the autoclaves. Crystals of neodymium fluoride (NdF_3) were equilibrated with solutions containing HF in concentrations ranging from 0 to 0.15 mol/l. The pH (1.34±0.1 at 25°C) and ionic strength (I) of the solutions were controlled by perchloric acid and sodium perchlorate, respectively. The solubility of neodymium fluoride was determined for sets of experiments with ionic strengths of 0.01, 0.05 and 0.15. Control experiments were also performed at ionic strengths of 0.5 and 1. After equilibrium was attained, the autoclaves were quenched, the crystalline NdF_3 was removed, any Nd species precipitated were dissolved by adding sulfuric acid to the experimental solutions and the concentrations of Nd and F were analysed



using ICP-MS and NAA.

The results of our experiments show that Nd^{3+} and NdF^{2+} are the dominant species in solution at the temperatures investigated. The data obtained were used to derive formation constants for NdF^{2+} and values of the solubility product for NdF_3. Dependence on ionic strength was modelled using the extended Debye-Hückel equation. The parameter b_γ ($NaClO_4$) for this equation and the distances of closest approach for Nd^{3+} and NdF^{2+} were also optimized based on the experimental data. The results of this study show that published theoretical predictions significantly overestimate the stability of NdF^{2+} and the solubility of NdF_3.