Experimental Determination of Solubility of $Nd(OH)_3(s)$ in Na_2SO_4 Solutions to High Ionic Strength: Applications to Nuclear Waste Isolation

YONGLIANG XIONG [1], LESLIE KIRKES[1], CASSIE MARRS[1]

[1] Sandia National Laboratories (SNL), Carlsbad Programs Group, 4100 National Parks Highway, Carlsbad, NM 88220, USA

Nd(III) is a good analog for actinides in the +III oxidation state. Sulfate is a major species in natural brines. However, solubilities of actinides in sulfate solutions are not well known. In this work, we investigate solubilities of $Nd(OH)_3(s)$ in Na_2SO_4 solutions over a wide range of ionic strengths up to 5.4 mol•kg^{-1} at 298.15 K. The synthesis method assures the complete conversion of Nd_2O_3 to $Nd(OH)_3(s)$, as demonstrated by XRD and SEM-EDS characterizations. The measured solubilities of $Nd(OH)_3(s)$ in Na_2SO_4 solutions are combined with the literature solubility data on $Nd_2(SO_4)$•$8H_2O$ in H_2SO_4 solutions to develop a Pitzer model to describe the Na-Nd-SO_4-H-OH system to high ionic strengths. This model is important for accurate predictions of actinde solubilities in solutions with high sulfate concentrations in nuclear waste isolation.

In addition, rare earth elements (REE) are used in numerous industries. Therefore, this model will also find applications in the sulfuric acid processing of REE concentrates and recycling process of REE.

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