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Heteronuclear hydrolysis complex of thorium(IV) and iron(III)

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The solubility of the Th(IV)/Fe(III) system has been studied as function of pH in the range 2.00-3.50. In the individual systems of thorium(IV) and iron(III) precipitation takes place due to formation of hydrolysis products. However, in the mixed Th(IV)/Fe(III) system precipitation of ferrihydrite takes place at low pH value, pH = 2.00, whereas at higher pH no precipitation was observed after 20 months. The mixed heteronuclear complex of composition $[\text{Th}_2\text{Fe}_2(\mu_2\text{-OH})_8(\text{H}_2\text{O})_{12}]_{10+}$ was formed in solution, with Th–Th, Th–Fe and Fe–Fe distances of 3.95 and 3.949; 3.42 and 3.4; 3.05 and 2.921 Å as determined by EXAFS and LAXS, respectively. Two and four line ferrihydrite was formed in solutions at low pH values, 2.00-2.30, as identified by X-ray diffraction (XRD). SEM analysis of these precipitates showed that some of them contained only iron, whereas the others contained both iron and thorium. Mixed Th/Fe system showed increased solubility what may affect the design of tanks for spent nuclear waste.

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