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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 [Th2Fe2(μ2-OH)8(H2O)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.

Primary authors: Mr RADKEVICH, Artsiom (, Joint Institute for Power and Nuclear Research –Sosny, Belorussian Academy of Sciences, 220109 Minsk, Belarus); Dr LUNDBERG, Daniel (Department of Chemistry, Swedish University of Agricultural Sciences, P.O.Box 7015, SE-756 51 Uppsala, Sweden); Dr DAVYDOV, Dmitri (Joint Institute for Power and Nuclear Research –Sosny, Belorussian Academy of Sciences, 220109 Minsk, Belarus); Prof. PERSSON, Ingmar (Department of Chemistry, Swedish University of Agricultural Sciences, P.O.Box 7015, SE-756 51 Uppsala, Sweden); Dr ERIKSSON, Lars (Department of Physical, Inorganic and Structural Chemistry, Stockholm University, SE-106 90 Stockholm, Sweden); Ms TORAPAVA, Natallia (Department of Chemistry, Swedish University of Agricultural Sciences, P.O.Box 7015, SE-756 51 Uppsala, Sweden)

Presenter: Mr RADKEVICH, Artsiom (, Joint Institute for Power and Nuclear Research –Sosny, Belorussian Academy of Sciences, 220109 Minsk, Belarus)

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