

Sorption of silicon on magnetite and other corrosion products of iron

Violaine Philippini^a, Aude Naveau^b, Hubert Catalette^a, Stéphanie Leclercq^a

^aElectricité de France, Research and Development, Les Renardières, Route de Sens-Ecuelles, 77818 Moret sur Loing cedex, France

^bUniversité de Reims, GRECI, Chimie de Coordination des Interfaces, BP 1039, 51687 Reims cedex 2, France

The sorption of Si on various iron corrosion products of nuclear waste canisters (magnetite Fe_3O_4 , goethite $\alpha\text{-FeOOH}$, and siderite FeCO_3) and pyrite FeS_2 was evidenced in the presence of a background electrolyte (NaCl or NaClO_4). For magnetite, goethite and siderite, Si sorption increased with pH in the 3–7 pH range. It reached a plateau, and finally it decreased at pH more than 9. Sorption capacities were determined for magnetite ($19 \cdot 10^{-6} \text{ mol}_{\text{Si}}/\text{g}_{\text{magnetite}}$), goethite ($79 \cdot 10^{-6} \text{ mol}_{\text{Si}}/\text{g}_{\text{magnetite}}$) and siderite ($20 \cdot 10^{-6} \text{ mol}_{\text{Si}}/\text{g}_{\text{magnetite}}$), while it could be neglected for pyrite since it is almost zero. Sorption data on magnetite was modelled using a surface complexation model with the bidentate surface complex $(\equiv\text{XO})_2\text{Si}(\text{OH})_2$ and $\lg K_{\text{complexation}} = 8.6$. Influence of magnetite on glass lifetime was evaluated and it was estimated negligible.