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Original

Formation, Decomposition and Cesium Adsorption Mechanisms of Highly Alkali-tolerant Nickel Ferrocyanide Prepared by Interfacial Synthesis

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Summary

Highly alkali-tolerant nickel ferrocyanide was prepared as an adsorbent for preventing the leaching of radioactive cesium from municipal solid waste incinerator fly ash containing large amounts of calcium hydroxide and potassium chloride, which act as an alkaline source and the suppressor for cesium adsorption, respectively. Nickel ferrocyanide prepared by contacting concentrated nickel and ferrocyanide solutions without mixing adsorbed cesium ions in alkaline conditions even the concentration of coexisting potassium ions was more than ten thousand times higher than that of the cesium ions. Large particles of nickel ferrocyanide slowly grew at the interface between the two solutions, which reduced the surface energy of the particles and therefore increased the alkali tolerance. The interfacially-synthesized nickel ferrocyanide was possible to prevent the leaching of radioactive cesium from cement-solidified fly ash for a long period. The mechanisms of the formation, selective cesium adsorption, and alkali-induced decomposition of the nickel ferrocyanide were elucidated. Comparison of the cesium adsorption mechanism with that of the other adsorbents revealed that an adsorbent can selectively adsorb cesium ions without much interference from potassium ions, if the following conditions are fulfilled. 1) The adsorption site is small enough for supplying sufficient electrostatic energy for the dehydration of ions adsorbed. 2) Both the cesium and potassium ions are adsorbed as dehydrated ions. 3) The adsorption site is flexible enough for permitting the penetration of dehydrated ions with the size comparable to that of the site.

Key Words: Cesium adsorbent, Municipal solid waste incinerator fly ash, Nickel ferrocyanide, Alkali tolerance, Interfacial synthesis