High-Temperature Cesium Capture Using Activated Kaolinite in the Presence of Chlorine and Volatile Heavy Metals

Hee-Chul Yang, Jeoung Guk Kim, Jae-Hyung Yoo and Joon Hyung Kim
Korea Atomic Energy Research Institute

Jong Sung Yoon
Chungnam National University

Abstract

This study investigated the use of porous activated kaolin particles in the size range of 300-400 μm as high-temperature sorbents for cesium capture in the presence of chlorine and/or in the presence of cadmium and lead. Packed bed sorption tests by passing CsCl-carrying flue gas through the packed bed of activated porous kaolin particles were first performed at the temperature range of 973-1173 K and a CsCl partial pressure range of 7.4-11.1 Pa. The observed structural change of the sorbent mineral at the stage of sorption revealed the characteristics of an irreversible chemical reaction as a major cesium capturing mechanism. In the fully saturated kaolin sorbent, $Cs_2O \cdot Al_2O_3 \cdot 2SiO_2$ is present as a sorption reaction product, together with much smaller amount of water-soluble cesium species. The increase in sorbent bed temperature resulted in an increase in the rate of sorption, but it had no effect on maximum cesium uptake. In the presence of other condensable gas-phase metal chlorides such as cadmium and lead, cesium was preferentially adsorbed onto tested activated kaolinite, but a half of cesium appeared to be physically-sorbed cesium species, CsCl.