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Abstract

Sodium nonatitanate powder is a layered material containing some potential exchangeable sodium ions between layers. In this work, sorption mechanism of this material has been studied and modeled at the solid-liquid interface. In particular, the ion-exchange mechanism is up to now not entirely known and especially the role of the pH on sorption properties. To investigate this latter, the solid is first equilibrated with inert acidic and base (nitric acid and triethylamine) for which the co-ions nitrate and triethylammonium do not penetrate the solid. The exchange between proton or divalent ions (strontium or calcium), and the sodium initially located in the sodium nonatitanate, is characterized through capillary ionic chromatography and conductivity experiments. To understand and explain the sorption properties, we modeled the equilibrium constant of different exchange reactions as a function of the solution pH. The equilibrium constants of the strontium/sodium and the calcium/sodium exchange have been obtained. We have shown the important role of the pH on the sorption rate of the strontium and moreover the hydrolysis rate of the sodium nonatitanate is calculated. We found that one eighth of sodium is spontaneously hydrolysed in aqueous phase whereas seven-eighths are exchanged by different divalent cations (strontium or calcium). Strontium and calcium exhibit similar exchange curves and competition with the proton adsorbed is modeled with global equilibrium constant. The prediction is in agreement with the conductivity experiments and the global extraction isotherms.

Keywords:
Sodium Nonatitanate, strontium sorption; conductivity; modeling

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