

Kinetic and Speciation of Ni Sorption on Beidellite.

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Spectroscopic studies have shown that Ni sorption on Al-bearing clay minerals can result in the formation of a Ni-Al layered double hydroxide (LDH). Several factors may influence the formation of these phases on clay minerals, including reaction pH and the permanent charge of the mineral. To investigate these factors, we have performed Ni sorption studies on beidellite, an aluminous smectite with tetrahedral substitution. Nickel sorption kinetics on beidellite were monitored at pH 6, 6.8, and 7.5 from 15 min to 21 days. At pH 6, extended x-ray absorption fine structure (EXAFS) spectroscopy showed the absence of LDH phases after 24 h. At pH 7.5 and a reaction time of 75 minutes, the predominant phase was a-Ni hydroxide with a small degree of Al substitution in the structure, as indicated by the Ni-Ni bond distance. After 24 h, a Ni-Al LDH phase was observed as indicated by the decrease in the Ni-Ni bond distance ($R_{\text{Ni-Ni}}=3.06 \text{ \AA}$, this value being indicative of a LDH phase). To support these findings, we will present diffuse reflectance spectroscopy (DRS) results since this technique is sensitive to the presence of Al in the LDH structure. Specifically, one observes a shift of the Ni (μ)₂ band from 14,180 cm^{-1} to 15,300 cm^{-1} when an Al-bearing precipitate forms. Our results indicated aging time and pH play an important role in the kinetics and mechanisms of Ni sorption on Al-bearing phyllosilicates.

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