

Kinetics of the Formation and Dissolution of Ni Precipitates on a Gibbsite/
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Many kinetic studies have shown that sorption of metals on single-component natural materials result in the formation of metal precipitates. Previous studies of Ni sorption on pyrophyllite demonstrated the rapid formation of mixed Ni-Al precipitates. However, the kinetics of Ni sorption on gibbsite ($\text{Al}(\text{OH})_3$) (mixed Ni-Al precipitates) and amorphous silica ($\text{Ni}(\text{OH})_2$ -like precipitates) are much slower than that of pyrophyllite. We examined the Ni sorption kinetics on a stoichiometric mixture of gibbsite and silica similar to pyrophyllite using a pH-stat batch technique, X-ray absorption fine structure (XAFS) and diffuse reflectance (DRS) spectroscopies, high-resolution thermogravimetric analysis (HRTGA), and high-resolution transmission electron microscopy (HRTEM). The rapid formation, within one hour, of mixed Ni-Al precipitates was observed on the gibbsite/silica mixture.

Replenishment dissolution experiments using nitric acid, EDTA, oxalate, and acetylacetone were conducted on Ni precipitates formed on pyrophyllite, gibbsite, amorphous silica, and the gibbsite/silica mixture after residence times ranging from one hour to one year. While the stability of the Ni precipitates on gibbsite and silica independently were much less than that of pyrophyllite, the gibbsite/silica mixture resulted in Ni precipitates whose stability were similar to those on pyrophyllite.

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