

Ni Sorption on Pyrophyllite: Evidence for the Formation of Ni-Al Hydroxide and Its Transformation into Ni-Silicate by Visible, Infrared and XANES Spectroscopy and Thermogravimetry

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Former EXAFS studies of the sorption of Co and Ni on Al-containing clay minerals suggest either the formation of layered double hydroxides or of layer silicates. Desorption studies indicate that the stability of the Ni phase increases with residence time. To investigate the causes of this aging effect, we monitored the Ni-pyrophyllite reaction over six months using an array of spectroscopic techniques. Both optical and XANES spectra prove the formation of Ni-Al hydroxide layers within 5 minutes. While the average Ni-O bond distance remains constant over time, IR and thermogravimetric data show changes of the interlayer composition and stability. Comparison of the spectra with those of synthetic mineral phases suggest the exchange of the initial NO_3^- interlayer anions by SiO_2^- . The subsequent polymerization of SiO_2^- causes the formation of 1:1 or 2:1 Ni silicates, where the original Ni-Al hydroxide structure is conserved in the octahedral layers.