Reduction and Reoxidation of Nontronite: Questions of Reversibility

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Abstract: Redox cycles are common in nature and likely have a profound effect on the behavior of soils and sediments. This study examined a key component of redox cycles in smectites, namely, the reoxidation process, which has received little attention compared to the reduction process. Unaltered (oxidized) and reoxidized ferruginous smectites (nontronites) were compared using infrared and Mössbauer spectroscopies, and thermal gravimetric analysis. The infrared and thermal gravimetric data revealed that the structural OH content of reduced-reoxidized clay is about 15 to 20% less than in the original (oxidized) sample, indicating that the structure remains partially dehydroxylated even after reoxidation. Mössbaner spectra of reoxidized samples consisted of larger quadrupole splitting for Fe(III) doublets than in the unaltered samples, suggesting that the environment of Fe(III) is more distorted after the reduction-reoxidation treatment.

Key Words: Dehydroxylation • Ferric • Ferrous • Hydroxylation • Infrared spectroscopy • Iron • Mössbauer spectroscopy • Nontronite • Oxidation • Reduction • Reoxidation • Smectite • Thermal gravimetric analysis • X-ray diffraction

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