

Energetic, Structural and Interfacial Evolutions in Hydration and Dehydration of Minerals with Layered Structures

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Hydration of minerals with layered structures is an important interfacial phenomenon which governs many critical geochemical processes in the Earth's critical zone. Here, I present our recent studies on the energetics, structural and interfacial evolutions during hydration and dehydration of a series of minerals and relevant synthetic layered materials, including clays layered double hydroxides (LDHs), and clay-like transition metal carbides (MXenes). These minerals were studied by both *in situ* X-ray diffraction (XRD) and *in situ* diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) to reveal the structural and interfacial phenomena during dehydration. Moreover, we employed integrated thermogravimetric analysis–differential scanning calorimetry–mass spectrometry (TG-DSC-MS) analyses, solution calorimetry and adsorption calorimetry to elucidate the energetics of water – layered mineral interactions. These fundamental studies enhance our fundamental understanding on interfacial chemistry between water and layered minerals on both Earth and near-earth planet such as Mars.