
Layer Charge Influences on the Hydration of Expandable 2:1 Phyllosilicates

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Abstract: The objective of this study was to investigate the influence of layer charge on the hydration of Mg-saturated expandable 2:1 phyllosilicates. Water retained by 12 Mg-saturated clays at 54% relative humidity was quantified gravimetrically. X-ray diffraction and total chemical analysis were used to determine the hydratable surface area ($447\text{--}759\text{ m}^2\text{ g}^{-1}$) and layer charge [$0.327\text{--}0.754$ electrons per formula unit (e f.u.⁻¹)] of each sample. Water retained by the clays increased with both hydratable surface area and layer charge of the clays. However, the increase in H₂O content with layer charge occurred only on external surfaces of the clays. This result suggests that the H₂O on external surfaces is localized around the cation/charge sites rather than forming multi-layers as was suggested previously. A model is proposed for the hydration of expandable 2:1 phyllosilicates. The model assumes that interlayer volume controls interlayer hydration and that the number of cation/charge sites on external surfaces controls hydration of external surfaces.

Key Words: External Surface • Hydration • Hydration Number • Layer Charge • SAz-1 • SHCa-1 • Surface Area • SWa-1 • Swelling • VTx-1

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