Apparent Charge Heterogeneity in Kaolins in Relation to Their 2:1 Phyllosilicate Content

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Abstract: Measurements of the differential heats of K-Ca exchange are used to show that 6 groups of sites (ranging from −13.8 to −5.1 kJ/eq and with as many as 4 in any one sample) exist in kaolins that range from 0 to 15% in their 2:1 phyllosillicate content. These heat values, coupled with entropies of exchange, suggest that 0.1 – 10% vermiculitic, micaceous, and smectitic layers are present, presumably interstratified with kaolinitic layers which are assumed to have no permanent charge. Changes in the activity coefficients of adsorbed K with K saturation confirm these conclusions qualitatively. Thus, f_K values at $x \rightarrow 0$ correlate inversely ($r^2 = 0.655$) with the content of vermiculite + partially expanding micas, and x values at maximum f_K indicate the content of vermiculite + nonexpanding mica + partially expanding micas ($r^2 = 0.732$).

Key Words: Cation exchange • Enthalpy • Heat • Kaolin • Smectite • Surface charge

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