Surface Charge Properties of Kaolinite

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Abstract: The surface charge components of 2 Georgia kaolinites of differing degrees of crystallinity (KGa-1 and KGa-2) were determined using procedures based on charge balance concepts. Permanent structural charge density (σ_0) was determined by measuring the surface excess of Cs, which is highly selective to permanent charge sites. The values of σ_0 determined were −6.3 ± 0.1 and −13.6 ± 0.5 mmol kg^{-1} for kaolinites KGa-1 and KGa-2, respectively. The net proton surface charge density (σ_H) was determined as a function of pH by potentiometric titration in 0.01 mol dm^{-3} LiCl. Correction from apparent to absolute values of σ_H was made by accounting for Al release during dissolution, background ion adsorption and charge balance. Lithium and Cl adsorption accounted for the remainder of the surface charge components. Changes in surface charge properties with time were measured after mixing times of 1, 3 and 15 h, the latter representing " equilibrium ". Time-dependent behavior is believed to be caused by mineral dissolution followed by readsorption or precipitation of Al on the mineral surface. Both the point of zero net charge (p.z.n.c.) and the point of zero net proton charge (p.z.n.p.c.) changed with mixing time, generally increasing. The " equilibrium " p.z.n.c, values were approximately 3.6 for KGa-1 and 3.5 for KGa-2, whereas the corresponding p.z.n.p.c. values were about 5.0 and 5.4. The p.z.n.c. results were in good agreement with previous studies, but the values of p.z.n.p.c. were higher than most other values reported for specimen kaolinite.

Key Words: Dissolution • Kaolinite • Point of Zero Charge • Potentiometric Titration • Proton Surface Charge • Structural Charge • Surface Charge • Surface Chemistry

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