
Surface Charge Characteristics of Amorphous Aluminosilicates

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Abstract: The surface charge characteristics of a range of synthetic amorphous aluminosilicates, hydrous alumina, hydrous silica and two allophanic soil clays were determined by the retention of Na^+ and Cl^- as counter-ions from 0.1 M NaCl solution. In the pH range investigated (3– 9), only negative charges could be detected in the hydrous silica and the most siliceous aluminosilicate [$\text{Al}/(\text{Al} + \text{Si}) = 0.29$], and only positive charges were detected in the hydrous alumina; whereas both positive and negative charges were detected in the more aluminous aluminosilicates and the soil allophanes. In all cases, the surface charges were pH-dependent and in the aluminosilicate series negative charge decreased and positive charge increased with $\text{Al}/(\text{Al} + \text{Si})$. Consequently, the point of zero charge increased with $\text{Al}/(\text{Al} + \text{Si})$.

The charge characteristics of the amorphous aluminosilicates could be explained by current models of their structure. Negative charge can be attributed to isomorphous substitution of Al for Si in the silicate structure and to the dissociation of silanol groups in structural and adsorbed silicate. Positive charge is attributed to protonation of hydroxy-aluminum species occupying cation exchange sites.

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