Surface titrations of albite and albite glass

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The surface structure and chemistry of minerals and glasses control in large part their reactivity in aqueous environments. The chemical nature and reactivity of surfaces can be changed by adsorption reactions at the fluid-solid interface. Perhaps the most fundamental reactions involve the adsorption of protons and hydroxyls on surface sites. On silicate minerals and glasses, the adsorption of H^+ and OH^- occurs primarily on 2 types of surface sites: >metal-OH groups and >metal-bridging oxygen-metal< sites (i.e. the symbol ">" refers to bonding to bulk framework).

The adsorption of H^+ and OH^- at various surfaces sites can be considered to be of particular importance in influencing not only the chemistry of surfaces, but also the dependence of the reactivity on pH. Several experimental and theoretical studies have shown that there is an apparent relationship between net surface charge, determined by adsorption of H^+ and OH^- on surface sites, and the rate of dissolution. One of the most useful methods for determining surface charge is by the surface titration technique.

The main purpose of this communication is to explore the relation between surface structure and surface charge as a function of solution pH. This relationship has been experimentally studied based on the surface titrations applied to 2 silicates: crystalline albite and albite glass. These two silicates were chosen since they have the same chemical composition ($NaAlSi_3O_8$), but different bulk structures. The adsorption behavior of albite and albite glass as a function of solution pH has been studied with respect not only to the difference in their structures, but also with respect to the following surface treatments: ageing over long periods of time (up to 7 years), annealing at temperatures to 800°C, chemical pretreatment (dissolution in acidic and basic pH solutions at elevated temperatures).