

DISSOLUTION RATES OF TALC AS A FUNCTION OF SOLUTION COMPOSITION, PH AND TEMPERATURE

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Steady-state talc dissolution rates, at far-from-equilibrium conditions, were measured as a function of aqueous silica and magnesium activity, pH from 1 to 10.6, and temperature from 25°C to 150°C. All rates were measured in mixed flow reactors and exhibited stoichiometric or close to stoichiometric dissolution. All measured rates at pH > 2 obtained at a fixed sodium concentration of 0.02 M can be described to within experimental uncertainty using

$$r = \bar{s}_{BET} A_A \exp(-E_A / RT) \left(\frac{a_{H^+}^2}{a_{Mg^{2+}}} \right)^{1/8}$$

where *r* signifies the BET surface area normalized talc steady-state dissolution rate, \bar{s}_{BET} denotes the specific BET surface area present in the reactor, *A_A* refers to a

pre-exponential factor equal to 5.8x10⁻¹⁰ mol cm⁻² s⁻¹, *E_A* designates an activation energy equal to 38 kJ mol⁻¹, *R* represents the gas constant, *T* denotes absolute temperature, and *a_i* refers to the activity of the subscripted aqueous species. This relationship closely resembles that of enstatite (MgSiO₃) and is consistent with talc dissolution rates being controlled by the detachment of partially liberated silica tetrahedral formed talc edge surfaces from the exchange of two protons for one Mg at the talc edge surfaces. Corresponding atomic force microscopic observations confirms that dissolution proceeds by the removal of T-O-T layers from the talc edge surfaces. At pH ≤ 2, the Mg²⁺ for proton exchange is so extensive that talc T-O-T sheets break apart at the edge surfaces leading to increased surface area and accelerated rates.