
Synthesis and Properties of Titanium Oxide Cross-Linked Montmorillonite

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Abstract: Titanium was introduced into the montmorillonite structure by cation exchange with polymeric Ti cations, formed by partial hydrolysis of TiCl_4 in HCl. On further hydrolysis and heating, TiO_2 pillars in the form of anatase were formed between the montmorillonite layers. The resulting TiO_2 -cross-linked montmorillonites possessed surface areas in the range 200– 350 m^2/g and pore volumes of about $0.2 \text{ cm}^3/\text{g}$ and were thermally and hydrothermally stable to 700°C . The basal spacing of products heated at temperatures $> 200^\circ \text{C}$ was about 28 \AA , as determined by X-ray powder diffraction and by N_2 -desorption pore-size analysis. The surface area increased and the pore volume decreased with increasing HCl-concentration in the Ti-solution. The uptake of TiO_2 by the montmorillonite, the surface area, and the pore volume increased with increasing amount of Ti added in the preparation, to about 10 mmoles of Ti/g of montmorillonite. A further increase in the amount of Ti added resulted in a decrease in surface area, but the pore volume and the uptake of TiO_2 remained almost constant. The high porosity and the interlayer spacing of the product are consistent with a structure similar to that previously proposed for smectites, cross-linked with hydroxy-Al oligocations.

Key Words: Cross-linked smectite • Montmorillonite • Pillared interlayer complex • Porosity • Thermal stability • Titanium oxide

Clays and Clay Minerals; December 1986 v. 34; no. 6; p. 658-664; DOI: [10.1346/CCMN.1986.0340606](https://doi.org/10.1346/CCMN.1986.0340606)
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