
Tin—Clay Complexes: A Mössbauer Study

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Abstract: Divalent tin has been intercalated into montmorillonite by reacting partially hydrolyzed solutions of SnCl₂ under aerobic conditions at pH = 2.8 with aqueous dispersions of the smectite mineral. The precursor tin solution contains mainly the cationic trimeric ion Sn₃(OH)₄²⁺, which is shown to take part in the exchange reactions with the surface cations of the mineral. Variable temperature Mössbauer spectroscopy was used in order to: 1) directly probe changes in the oxidation state and coordination environment of Sn²⁺ in the process of intercalation; 2) examine the nature of tin atoms on the external surfaces and in the interlayer space of the clay platelets; and 3) study the dynamics of motion of tin atoms on the clay surfaces.

The main conclusion from these studies is that about 75% of the Sn²⁺ ions undergo extensive oxidation to the +4 state with concomitant hydrolysis and condensation that lead to the precipitation of SnO₂ on the external surfaces of the clay. The rest of the Sn²⁺ ions are introduced into the lamellar zone, as evidenced by the detailed Mössbauer analysis of the dynamics of motion of tin atoms on the clay surfaces.

Key Words: Clay • Montmorillonite • Mössbauer • Intercalation

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