
Ion Exchange and Intersalation Reactions of Hectorite with Tris-Bipyridyl Metal Complexes*

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Abstract: The binding of tris-bipyridyl metal complexes of the type $M(\text{bp})_3^{2+}$ ($M = \text{Fe}^{2+}, \text{Cu}^{2+}, \text{Ru}^{2+}$) to hectorite surfaces is shown to occur by two mechanisms: (1) replacement of Na^+ ions in the native mineral by cation exchange up to its cation exchange capacity and (2) intersalation of excess salt beyond the exchange capacity. In the cation exchange mechanism, the binding of metal complex is strongly favored over Na^+ . The intersalation reactions are dependent on the nature of the counter-anion: $\text{SO}_4^{2-}, \text{Br}^- > \text{ClO}_4^-, \text{Cl}^-$. The homoionic $M(\text{bp})_3^{2+}$ -hectorites, which exhibit rational 18 Å X-ray reflections, have been characterized with regard to their BET surface areas, water adsorption isotherms, types of water present, selected reactions in the intercalated state, and orientation of the complex ions in the interlayer regions. Mixed $\text{Fe}(\text{bp})_3^{2+}, \text{Na}^+$ -hectorites have also been examined and the results suggest segregation of the two ions between interlayers or within interlayers. Solid state intersalated phases have been isolated with 18 Å and 29.5 Å spacings. In general, surface areas of the intersalated phases are low, but the 18 Å phase derived from $[\text{Fe}(\text{bp})_3]\text{SO}_4$ adsorption shows a high surface area, which even exceeds the surface area of homoionic $\text{Fe}(\text{bp})_3^{2+}$ -hectorite.

Key Words: Bipyridyl • Exchange • Hectorite • Intersalation • Tris-bipyridyl

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