

Magnetism in intercalated compounds of layered manganese thiophosphate

N V VENKATRAMAN and S VASUDEVAN

Department of Inorganic and Physical Chemistry, Indian Institute of Science,
Bangalore 560 012, India

Layered manganese thiophosphate MnPS_3 undergoes an unusual ion-exchange intercalation reaction in which solvated cation G^+ (solv) can be inserted into the galleries with loss of Mn^{2+} from the layers to give $\text{Mn}_{1-x}\text{PS}_3 \cdot \text{G}_{2x}^+$ (solv). Intercalation occurs with dilation of the lattice. The host MnPS_3 is a two-dimensional antiferromagnet. The intercalated compounds, however, show weak ferromagnetism at low temperatures. When the guest cations are hydrated ions, the intercalates are unstable, losing water to give $\text{Mn}_{1-x}\text{G}_{2x}\text{PS}_3$. In order to keep the guest cations within the galleries, we have exchanged the water of hydration in the intercalated compounds, $\text{Mn}_{0.75}\text{PS}_3\text{K}_{0.5}(\text{H}_2\text{O})$ and $\text{Mn}_{0.75}\text{PS}_3\text{Mn}_{0.25}(\text{H}_2\text{O})$, with a crown-ether (18-crown-6-ether). The stronger chelating action of the crown-ether prevents the guest cations from slipping into the layer. The magnetic properties of these compounds have been investigated in order to understand the origin of weak ferromagnetism in intercalated compounds of MnPS_3 .