
Interstratification in Malawi Vermiculite: Effect of Bi-Ionic K-Mg Solutions

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Abstract: The conversion of Malawi vermiculite into K-vermiculite by treatment with bi-ionic K-Mg solutions of 1 N total ion concentration (KCl and MgCl₂ mixed solutions of ionic strength equal to 0.5) was studied by following the 00l X-ray powder diffraction (XRD) reflections. Flakes of Mg-saturated samples were treated at 160° C during 24 hr with bi-ionic solutions, with the K concentration varying from zero to pure 1 N KCl solution. The K-Mg interlayer exchange began at a critical value $x_K = .0196$ ($K/Mg = 1/100$) of the molar fraction of K in the solution. Above the critical concentration and extending to pure 1 N KCl, the XRD diagrams were characteristic of a 10- Å/14- Å interstratification that had a marked tendency towards regularity. Experiments with KCl and MgCl₂ mixed solutions of ionic strength equal to 0.75 and 1.0 showed that the exchange began at the same critical value x_K as the experiments with ionic strength equal to 0.5, if the K added was equivalent. X-ray fluorescence analysis further showed that the amount of K adsorbed was proportional to the molar fraction x_K and to the proportion of K-saturated layers (10 Å) in the interstratification. To explain the mechanism of this quasi-regular interstratification, a crystallochemical rather than a thermodynamic mechanism is proposed.

Key Words: Interstratification • Ion exchange • Magnesium • Potassium • Vermiculite • X-ray powder diffraction

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