

Calculations of fluid–ternary solid solution equilibria: An application of the Wilson equation to fluid–(Fe,Mn,Mg)TiO₃ equilibria at 600 °C and 1 kbar

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ABSTRACT

The Wilson equation (Wilson 1964) is applied to (Fe,Mn,Mg)TiO₃ solid solutions for obtaining the mixing properties of the ternary solid solution at 600 °C and 1 kbar. The present study utilizes data on cation exchange between (Fe,Mn)Cl_{2(aq)} and (Fe,Mn)TiO₃, between (Mn,Mg)Cl_{2(aq)} and (Mn,Mg)TiO₃, and between (Fe,Mg)Cl_{2(aq)} and (Fe,Mg)TiO₃ (Kubo et al. 1992). The molar excess Gibbs energy (G^{ex}) is the following: G^{ex} (kJ/mol) = $-7.260[X_{\text{FeTiO}_3} \ln(X_{\text{FeTiO}_3} + 1.314X_{\text{MnTiO}_3} + 0.962X_{\text{MgTiO}_3}) + X_{\text{MnTiO}_3} \ln(0.585X_{\text{FeTiO}_3} + X_{\text{MnTiO}_3} + 0.393X_{\text{MgTiO}_3}) + X_{\text{MgTiO}_3} \ln(0.406X_{\text{FeTiO}_3} + 0.371X_{\text{MnTiO}_3} + X_{\text{MgTiO}_3})]$, where X stands for the mole fraction of the subscripted component. The predicted compositions of (Fe,Mn,Mg)Cl_{2(aq)} fluids in equilibrium with the ternary solid solutions are in good agreement with the experimental values.