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Acquisition and evaluation of thermodynamic data for bieberite-moorhouseite equilibria at 0.1 MPa

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ABSTRACT

Published estimates for the equilibrium relative humidity (RH) at 25 °C for the reaction: bieberite ($\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$) = moorhouseite ($\text{CoSO}_4 \cdot 6\text{H}_2\text{O}$) + H_2O , range from 69.8 to 74.5%. To evaluate these data, the humidity-buffer technique was used to determine equilibrium constants for this reaction between 14 and 43 °C at 0.1 MPa. Reversals along five humidity-buffer curves yield $\ln K = 18.03 - 6509.43/T$, where K is the equilibrium constant, and T is temperature in K. The derived standard Gibbs free energy of reaction is 9.43 kJ/mol, which agrees well with several previously reported values based on vapor-pressure measurements. It also agrees well with values calculated from the data derived mostly from calorimetric measurements. Previous studies indicated that the temperature of the invariant point for the assemblage bieberite-moorhouseite-aqueous solution-vapor is near 44.7 °C, and our extrapolated data predict 91.1% RH at this temperature; the predicted position for the invariant point is in excellent agreement with those reported previously.