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A low-temperature heat-capacity study of synthetic anhydrous Mg-cordierite ($Mg_2Al_4Si_5O_{18}$)

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ABSTRACT

The heat capacity of synthetic anhydrous Mg-cordierite ($Mg_2Al_4Si_5O_{18}$) was measured using adiabatic calorimetry between 6 and 300 K. Mg-cordierite was synthesized from a glass of stoichiometric cordierite composition at 1250 °C for one week. The refined cell dimensions using powder X-ray diffraction give a = 17.0553(2) Å, b = 9.7167(1) Å, and c = 9.3375(1) Å with V = 1547.428(1) Å^3 and a distortion index of Δ = 0.25 indicating complete Al-Si ordering. The absence of channel H_2O was confirmed by powder IR spectroscopy, which did not show the presence of any bands located around 3600 cm^{-1}. The C_P results values agree with those obtained previously by Weller and Kelley (1963) who measured the C_P of Mg-cordierite between 50 K and 298 K. The calculated entropy of Mg-cordierite at standard condition is $S^0_{298.15}$ = 404.0 ± 1.6 J/(mol·K) using the C_P data from this study. This value is in agreement with the value presented by Weller and Kelley [407.2 ± 3.77 J/(mol·K)], but appears to be very slightly lower than estimates made from various modeling studies incorporating phase-equilibrium data on Mg-cordierite.

Keywords: Calorimetry, cordierite, low-temperature study, crystal synthesis