

Thermodynamic properties of stishovite by low-temperature heat capacity measurements and the coesite-stishovite transition boundary

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ABSTRACT

The low-temperature isobaric heat capacity (C_p) of synthetic stishovite was measured between 2 and 311 K by the thermal relaxation method. The measured C_p is considerably smaller than that of Holm et al. (1967) over the whole temperature range studied. The standard entropy, $S_{298.15}^0$, of stishovite obtained is 24.0 J/(mol·K), which is 3.8 J/(mol·K) lower than that of Holm et al. (1967). Using the measured C_p , the Debye temperature and thermal Grüneisen parameter at 298.15 K were calculated to be 1109 K and 1.68, respectively. The equilibrium coesite-stishovite transition boundary was calculated using the $S_{298.15}^0$ of stishovite from published thermodynamic data. The calculated boundary has a slope of 3.2 ± 0.1 MPa/K at 1200–1600 K, which is larger than the slope determined by the high-pressure in situ X-ray diffraction study by Zhang et al. (1996).

Keywords: Stishovite, heat capacity, entropy, coesite, high pressure, phase transition, Debye temperature, thermodynamic property