

## The Effect of Pressure on the Transition of $ZrO_2$

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### Abstract

The effect of pressure on the monoclinic-tetragonal reversible transition of  $ZrO_2$  was investigated. The pressure dependency of the above transition was estimated to be  $dT_c/dP = -3.02 \times 10^{-2}$  deg.bar<sup>-1</sup> from the thermodynamic data of  $ZrO_2$  by Whitney. As the experimental result has not been obtained yet, the experiment of the pressure effect on this transition was tried, to compare it with the calculated value.

A Kennedy type piston-cylinder high pressure apparatus was used and the transition points were detected by the electrical resistance measurement of  $ZrO_2$  under high temperatures and high pressures. The measurements were carried out in the temperature and pressure ranges up to 1300°C and 30 kb, respectively.

One sample of  $ZrO_2$  used in the present experiment is the  $ZrO_2$  powder obtained by Monsanto Chemical Co. Using the above sample, the transition point and the molar volume change were measured by High temperature X-ray diffraction at the atmospheric pressure. The monoclinic-tetragonal transition point  $T_c^{M \rightarrow T}$  was 1140°C and the molar volume change  $\Delta V^{M \rightarrow T}$  was  $-0.95$  cm<sup>3</sup>/mol. As the entropy change,  $S^{M \rightarrow T}$ , the value by Coughlin and King was used, which is  $S^{M \rightarrow T} = 0.96$  cal/mol.deg. Using the Clausius-Clapeyron equation, the pressure effect on the transition was calculated to be  $-1.2 \times 10^{-2}$  deg.bar. On the other hand, the pressure dependency of the transition point obtained by the experiment was  $-1.6 \times 10^{-2}$  deg.bar.