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Equation of state of stishovite to lower mantle pressures

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ABSTRACT

We performed new diffraction experiments to clarify the equation of state (EoS) of stishovite after we suspected systematic errors in previous experimental reports. Using diamond anvil cells, we repeated both single-crystal X-ray diffraction measurements under hydrostatic conditions and powder diffraction measurements using the laser-annealing technique and NaCl pressure medium. The major improvement is the increase in precision of the pressure determination using the quartz and NaCl equations of state. Using both sets of data, the stishovite bulk moduli were refined to K_0 = 309.9(1.1) GPa and K'_0 = 4.59(0.23). We also reinvestigated the mechanism of the phase transformation to the $CaCl_2$-structured polymorph of SiO_2 at about 60 GPa. We confirm no volume discontinuity at the transition pressure, but the $CaCl_2$ form appears slightly more compressible than the rutile-structured form of SiO_2. This change in compression behavior is used for quantitative analyses of the spontaneous strains of the pressure-induced phase transition.