American Mineralogist, Volume 94, pages 205–209, 2009

Determination of high-pressure phase equilibria of Fe_2O_3 using the Kawai-type apparatus equipped with sintered diamond anvils

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Abstract

Phase equilibria of Fe_2O_3 have been studied up to 58 GPa and 1400 K using the Kawai-type multi anvil apparatus equipped with sintered diamond anvils. Identification of phases and pressure determination has been carried out by means of in situ X-ray observation using synchrotron radiation at SPring-8. Hematite (phase I) successively transforms to the Rh_2O_3(II)-type structure (phase II) and then to an orthorhombic structure (phase III) with increasing pressure. The transformations of hematite into high-pressure phases have been observed only at temperatures higher than 500 K, which is not concordant with previous results obtained by using the diamond anvil cell. Volume changes accompanied by the I-II and II-III transformations are calculated to be –2.8 and –5.0%, respectively. The phase boundary between I and II phases and that between II and III have been proposed to be P (GPa) = –0.015 T (K) + 44.2 and P (GPa) = –0.005 T (K) + 48.7, respectively. Possible correlation between a Mott transition and the phase stabilities may be concealed at room temperature due to slow reaction kinetics of the structural transformations.

Keywords: High-pressure phase equilibria, Fe_2O_3, Kawai-cell, sintered diamond, in situ X-ray observation