

In situ X-ray observation of 10 Å phase stability at high pressure

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ABSTRACT

The 10 Å phase, $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2 \cdot \text{H}_2\text{O}$, is a high-pressure hydrous phyllosilicate considered as an important link in the succession of hydrous phases transporting water into the deep mantle. In this study, in situ synchrotron X-ray diffraction combined with external heating diamond-anvil cell was used to determine limits of the 10 Å phase stability at pressures above 7 GPa. A reaction “10 Å phase + H_2O → hydroxide-perovskite (3.65 Å phase) + stishovite” at about 10 GPa was found to be a high-pressure boundary of the 10 Å phase stability field. A dehydration temperature of the 10 Å phase “10 Å phase → enstatite + stishovite + H_2O ” decreases with pressure from 690 °C at 7 GPa to 450 °C at 10 GPa; a nonvariant point where 10 Å phase, hydroxide-perovskite and enstatite coexist in the presence of stishovite and hydrous fluid was found near 10 GPa and 450 °C.

Keywords: 10 Å phase, 3.65 Å phase, hydroxide-perovskite, DHMS, deep water cycle