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Phase transitions between high- and low-temperature orthopyroxene in the $Mg_2Si_2O_6$-$Fe_2Si_2O_6$ system

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Abstract

We observed isosymmetric phase transitions of orthopyroxene in the $Mg_2Si_2O_6$-$Fe_2Si_2O_6$ system during high-temperature in situ X-ray powder diffraction experiments with a multiple-detector system and a high-temperature strip heater chamber in an atmosphere of Ar plus 1% H_2. The transition temperatures we determined for natural orthopyroxenes were 1113–1147, 1120–1139, and around 1200 °C for Fs_{10}, Fs_{14}, and Fs_{37}, respectively, and those for synthetic orthopyroxenes were 1048–1075, 961–1048, and 1037–1148 °C for Fs_{20}, Fs_{30}, and Fs_{46}, respectively. Our experiments showed that the transition from low- to high-temperature orthopyroxene in the $Mg_2Si_2O_6$-$Fe_2Si_2O_6$ system occurred at about 1000–1200 °C. We concluded that the stability field of low-temperature orthopyroxene was below 1000 °C and that of high-temperature orthopyroxene was above 1200 °C.

Keywords: Orthopyroxene, X-ray powder diffraction, isosymmetric phase transition, enstatite-ferrosilite system