

LETTER

In situ observation of the breakdown of magnetite (Fe_3O_4) to Fe_4O_5 and hematite at high pressures and temperatures

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ABSTRACT

In situ synchrotron X-ray powder diffraction measurements using a Paris-Edinburgh pressure cell were performed to investigate the nature of the high-pressure breakdown reaction of magnetite (Fe_3O_4). Refinement of diffraction patterns reveals that magnetite breaks down via a disproportionation reaction to Fe_4O_5 and hematite (Fe_2O_3) rather than undergoing an isochemical phase transition. This result, combined with literature data indicates (1) that this reaction occurs at ~9.5–11 GPa and 973–1673 K, and (2) these two phases should recombine at yet higher pressures to produce an *h*- Fe_3O_4 phase.

Keywords: Fe_4O_5 , magnetite, phase transformation, high pressure