In situ observations of high-pressure phase transformations in mantle minerals at SPring-8

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Phase transformations in mantle minerals and rocks have been studied using in situ X-ray diffraction measurements at high temperature and high pressure. We were able to conduct such experiments at pressures up to 25 GPa and at temperatures to 2000 C using a combination of white X-ray and a large multianvil device at SPring-8, a newly constructed third-generation synchrotron source. It is demonstrated that the pressures required for the postspinel phase transformations both in Mg2SiO4 and a pyrolite mantle composition were significantly lower than the earlier estimations based on quench experiments.