Structure and behavior of the Ni end-member schreibersite Ni_3P under compression to 50 GPa

SASITHORN CHORNKRATHOK [1,2,*], DONGZHOU ZHANG [2] AND PRZEMYSLAW DERA [2]

[1] Department of Earth sciences, University of Hawai'i at Mānoa, Honolulu, Hawai'i, USA (*correspondence: cs65@hawaii.edu)

[2] Hawai'i Institute of Geophysics and Planetology, University of Hawai'i at Mānoa, Honolulu, Hawai'i, USA (dzhang@hawaii.edu (D.Z.), pdera@hawaii.edu (P.D.)

Introduction and Method

The crystal structure and compressional behavior of the metal-rich of Ni-P binary compounds, the Ni end-member schreibersite have been investigated using synchrotron X-ray diffraction experiments. In our experiments both powder and two single crystal samples of synthetic Ni_3P in different orientations with respect to the loading axis of the diamond anvil cell were compressed up to approximately 50 GPa at ambient temperature.

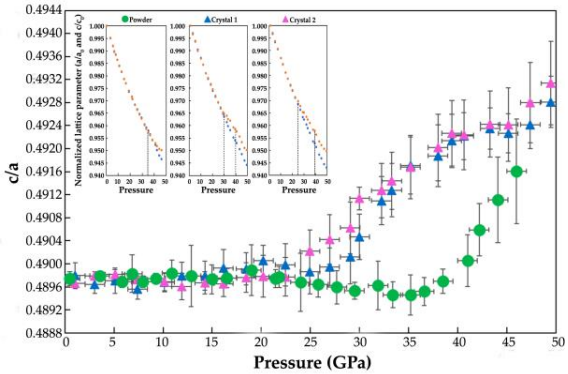

Figure 1 :The c/a axial ratio of Ni_3P at different pressures at room temperature. The graphs at top-left corner are the normalized lattice parameters (a/a_0 and c/c_0) of Ni_3P

Discussion of Results

The compressional data of Ni_3P were fitted by the 3rd order Birch–Murnaghan equation of state, All data indicates that at low pressure (< 30 GPa), the c/a ratio of unit cell parameters remains approximately constant but starts to increase steadily above that pressure and experiences a second slight discontinuity at approximately 40 GPa. The changes in unit cell parameters at ~30 GPa and ~40 GPa suggest discontinuous changes in magnetic ordering. Moreover, the threshold of these subtle discontinuities is sensitive to the stress state and orientation of the crystal in the diamond anvil cell. This study is the first report of compressional behaviour of both powder and single crystal Ni_3P up to 50 GPa and offers insights into the effects of Ni_3P components on the compressional behaviour of schreibersite in the Earth's core.