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# In situ stress-strain measurements in a deformation-DIA apparatus at *P-T* conditions of the upper part of the mantle transition zone

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## Abstract

We report on technical improvements in experiments with a deformation-DIA (D-DIA) apparatus, which enable the study of the rheology of solid materials at *P-T* conditions of the Earth's mantle transition zone. Dimensions of the anvil truncation, pressure medium, and gasket were optimized to achieve deformation experiments above 13 GPa with a relatively low press load (<0.7 MN) to minimize the damage of the X-ray transparent second-stage anvils. The adoption of low X-ray absorbing material (e.g., cubic BN anvils, graphite window in a $LaCrO_3$ heater) along the X-ray path enabled quantitative determination of stress and strain of a sample by means of simultaneous in situ X-ray radial diffraction and radiography using synchrotron radiation at SPring-8. Based on the new technique, a uniaxial deformation experiment with a strain rate of $3.88 \times 10^{-5}$ $s^{-1}$ and strains up to 25.5% was carried out on wadsleyite at a pressure of 14.5 GPa and a temperature of 1700 K.

**Keywords:** Rheology, viscosity, mantle transition zone, wadsleyite, stress, strain, deformation-DIA apparatus