

Twinning in wadsleyite

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Twinning was discovered in wadsleyite, which is the most abundant mineral at the upper part of the mantle transition zone. Wadsleyite crystals were synthesized from a powder of San Carlos olivine with distilled water at a pressure of 15 GPa and a temperature of 1670 K for 3 h using a multi-anvil apparatus. The wadsleyite twin was found based on change in color at a twin boundary due to strong pleochroism of wadsleyite by observing a thin section of the twin by optical microscopy. A thin foil perpendicular to the twin boundary was cut by focused ion beam (FIB) and was observed by transmission electron microscopy (TEM). The TEM observation revealed that twin domains make a 180° rotation about an axis perpendicular to the {101} plane in the pseudo-cubic system (cf. ringwoodite). Moreover, the composition plane of the twin domains is the {101} plane in the pseudo-cubic system. The wadsleyite twinning may be important in phase transformation, growth and deformation.

Keywords: mantle transition zone, wadsleyite, twinning, twin, twin boundary, high pressure