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LETTER

Synthesis of large wadsleyite single crystals by solid-state recrystallization

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ABSTRACT

Single crystals of $(Mg_{0.89}Fe_{0.11})_2SiO_4$ wadsleyite with dimensions up to ~1 mm were synthesized by solid-state recrystallization under high pressure. Synthesis experiments of the wadsleyite single crystals were performed at 16 GPa and 1870 K for 1–3 h using a Kawai-type multi-anvil apparatus. The wadsleyite crystals are virtually free of inclusions and cracks. Their chemical compositions are homogeneous with Fe/(Mg + Fe) of 0.112(2). Unpolarized infrared spectra indicate that the synthesized sample contains 0.15–0.30 wt% H_2O. The method of synthesizing large, high-quality single crystals of wadsleyite will facilitate future measurements of physical properties including elasticity and elastic anisotropy, electrical and thermal conductivities, atomic diffusivity, and creep strength, which will improve models of the composition and dynamics of the mantle transition zone.

Keywords: Wadsleyite, single crystal, mantle transition zone, high-pressure synthesis, Kawai-type multi-anvil apparatus