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Weak-beam dark-field TEM characterization of dislocations in wadsleyite deformed in simple shear at 18 GPa and 1800 K

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Characterization of dislocations in textured wadsleyite is important in understanding crystallographic preferred orientation (CPO) of wadsleyite and in turn seismic anisotropy at the mantle transition zone. A [001](010)-textured wadsleyite was recently obtained by deformation experiments on wadsleyite in simple shear at 15-18 GPa and 1770-1870 K with a deformation-DIA apparatus (Kawazoe et al., 2013; Ohuchi et al., 2014). However, [001] dislocations have been rarely reported in wadsleyite in the literature (cf. Cordier, 2002). To reconcile the wadsleyite CPO pattern with its slip systems, dislocation microstructures of the [001](010)-textured wadsleyite have been investigated in weak-beam dark-field imaging in a transmission electron microscope. 1/2<101>partial dislocations on the (010) plane are characterized with [100] dislocations on the (001) plane and 1/2<111>dislocations forming {011} slip bands. The former partial dislocations are extended on the (010) stacking fault as a glide configuration (i.e. Shockley-type stacking faults with 1/2<101>displacement vector). The [001] slip on the (010) plane occurs by glide of the dissociated dislocations on a sub-oxygen close packing plane, which can play an important role to generate the crystallographic preferred orientation patterns reported in water-poor deformation conditions (e.g., Kawazoe et al. 2013, Ohuchi et al. 2014).

キーワード: wadsleyite, crystallographic preferred orientation, dislocation, seismic anisotropy, transmission electron microscopy, deformation-DIA apparatus
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