

Transport properties of the Mantle Transition zone minerals

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We have studied transport properties of the mantle transition zone minerals, wadsleyite and ringwoodite, at high pressure and temperature, such as diffusion of hydrogen and dihedral angles between wadsleyite and fluid at high pressure and temperature.

Hydrogen is accommodated in the major mantle transition zone minerals such as wadsleyite and ringwoodite. Since the mantle transition zone is one of the major water reservoirs in the Earth, it is very important to identify the current water content and water distribution in the mantle transition zone.

We have determined the hydrogen diffusion in ringwoodite under the transition zone conditions in order to evaluate the homogeneity in terms of the hydrogen content in the mantle transition zone. The diffusion rate of hydrogen is comparable to that of wadsleyite determined previously (Hae et al., 2005).

We also determined the dihedral angle between wadsleyite and fluid at high pressure and temperature. The dihedral angle is very small less than 30 degrees, which indicates that fluid is percolative in the mantle transition zone. The diffusion rate of hydrogen in wadsleyite and ringwoodite indicates that its diffusion is not fast enough to homogenize the hydrogen content in the transition zone within the geological time scale of slab subduction. Although fluid is percolative in the mantle transition zone, a large amount of water which can saturate in wadsleyite and ringwoodite phases at least locally is needed to stabilize fluid. Therefore, three factors such as diffusion of hydrogen, water saturation, and percolation of water, are essential to discuss the distribution of water in the mantle transition zone.