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Fe2+ diffusion coefficients in MgO

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(Mg,Fe)O is one of the main minerals in the lower mantle. Its diffusion cofficients are critical to kinetics processes in the lower mantle. Yamazaki and Irifune measured the Fe2+ diffusion coefficients in MgO(2002:The Japan Society of High Pressure Science and Technology). But they used single MgO and powder (Mg,Fe)O. Occurring the grain boundary diffusion might increase their value. We have measured this diffusion coefficient using a multianvil high-pressure apparatus.

Experiments were done by a multianvil high-pressure apparatus at Tokyo Institute of Technology(SPI-1000). One polished surface of MgO single crystal was coated by pure Fe, which was oxidized to FeO in a gas-controlled furnace. The experimental conditions were done at 3-9GPa, 1673,1873K, 1-7hours. The diffusion profiles were measured by using EPMA(JXA-8800).

Diffusion coefficients were calculated from the obtained diffusion profiles assuming that Diffusion coefficients were independent to FeO concentration. Calculated diffusion coefficients were 3.3*10~(-15)m^2/s at 1673K, 1.6*10~(-14)m^2/s at 1873K at 3GPa and 1.2*10^(-15)m^2/s at 1673K, 3.2*10^(-14)m^2/s at 1873K at 9GPa. Diffusion coefficients are decreased with increasing pressure in 1673K, but not in 1873K. At 1873K, MgO crystal was broken into smaller crystals in the near of FeO faces and grain boundary diffusion occurred.

Yamazaki and Irifune measured the diffusion coefficients 8.0*10^(-15)m^2/s at 1673K, 14GPa. Our value is less than their value. This difference could be inflenced from the FeO concentration factor.