H-D inter-diffusion in Fe-free wadsleyite: implication for multiple hydrogen mechanism

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It has been proposed that concentration and speciation of water-derived species in minerals may adjust in response to changes of points defect condition [*Demouchy and Mackwell*, 2006], To lift the veil of Fe effect on hydrogen diffusion and isotopic differentiation, a sets of H-D inter-diffusion experiments were conducted in Fe-free wadsleyite single crystal couples at various temperatures, 16 GPa and compared with our former study on Fe-bearing wadsleyite. Distinguish with symmetric profiles in Fe-bearing condition, H-D inter-diffusion in Fe-free wadsleyite revealed evidently asymmetric properties and it indicates deuterium diffuses about 1 order faster than hydrogen in Fe-free wadsleyite. Both magnitude and anisotropy of H-D inter-diffusion in Fe-free condition are largely different with Fe-bearing condition, which strongly demonstrated a multiple hydrogen mechanism proposed by *Karato* (2013) association with free proton migration in interstitial sites. Simulation model suggests free proton migration in interstitial sites dominates the hydrogen diffusion in Fe-free condition and asymmetric properties might owe to the distinguished jumping probabilities from Mg sites to interstitial sites between hydrogen and deuterium.

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