

SIT037-P01

Room: Convention Hall

Time: May 26 17:15-18:45

Dynamic grain growth under mantle superplasticity

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We investigated grain size evolution during superplastic flow of forsterite-periclase system. Grain growth rate was much faster than the growth rate at static condition (no stress) exhibiting deformation induced grain growth in the system. We found that the rate is simply explained by a total strain.

Grain size in subducting slab is considered to be extremely fine after phase transition. Further, the grain growth after the transition is very slow so that grain size in the stagnant slab at upper part of the lower mantle hardly reaches 10 micron, which is predicted from grain growth law in perovskite and periclase two phase system (Yamazaki et al. 1996). Yamazaki and Karato (2001) showed that grain size in that region has to be ~ 3 mm to explain the estimated viscosity. We will show that the large discrepancy between predicted grain sizes can be explained by dynamic grain growth.

Keywords: grain growth, stagnant slab