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Influence of anisotropic grain growth on development of lattice preferred orientation of forsterite

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It is believed that LPO (lattice preferred orientation) of main mineral of mantle is caused by the flow of the Earth's interior, which introduces seismic anisotropy. Generally, it is considered that LPO (and seismic anisotropy) is generated by rock deformation via dislocation creep. In this study, we deformed mineral aggregates of forsterite + diopside by uniaxial compression and tension tests at atmospheric pressure, temperature of 1200 to 1350 degree, and strain rate of $1x10^{-6}$- $1x10^{-4}$ s^{-1}. The stress exponent (n) of 1 was obtained from the analysis of stress-strain relationship showing the aggregates deformation via diffusion creep mechanism. Crystallographic orientation analysis of forsterite grains in the deformed aggregates was conducted using electron backscatter diffractometry. The results show b-axis alignment parallel to the compression axis in the compressed samples and a-axis alignment in the tensiled samples. Long axis of grains in statically annealed samples is often parallel to a-axis of forsterite. We consider that the LPO development under diffusion creep is attributed to the alignment of anisotropic shaped of forsterite to the tensile direction after its anisotropic grain growth.