sintering polycrystalline olivine from pulverized olivine crystals

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The rheological properties of Earth’ s interior have been determined by laboratory experiments of polycrystalline samples of rock-forming minerals. In these deformation experiments, fine-grained specimens are often required for deformation in diffusion creep regime at laboratory strain rates (e.g. Karato, 2010). In this study, we successfully fabricated olivine nano-sized powder from naturally occurring olivine single crystal (peridot:$Mg_{1.76-1.84}Fe_{0.16-0.24}SiO_4$). In order to investigate a method for preparing fine-grained and highly dense nanocrystalline olivine, the sintering behavior of olivine powder was studied. Olivine powder were pressed into cylindrical shape and sintered under argon flow at temperatures ranging from 1130-1350 ℃ for 2-6 hours. After the sintering, sample surfaces were polished and thermally etched to expose grain boundaries. Grain size and porosity were determined from the microstructure of scanning electron microscope. Olivine grains in sintered samples are polygonal and isotropic shape, and show a homogeneous structure. The average grain size increased with increasing sintering time and sintering temperature, and a significant grain growth was found for the sample sintered at 1350 ℃. At temperatures of 1300 ℃, we could obtain dense polycrystalline olivine with an average grain size of $< 2\ \mu m$.

Keywords: sintering, olivine, polycrystsalline

