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曹灰長石ナノ多結晶体の焼結と粒成長
Grain growth of nanocrystalline labradorite

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Plagioclase is a solid solution series that ranges from albite to anorthite endmembers (with respective compositions $NaAlSi_3O_8$ to $CaAl_2Si_2O_8$). Plagioclase is a major constituent mineral in the Earth's crust. Its physical and chemical properties are important for establishing the overall rheology of Earth's crust. Previous experimental studies on sintering on plagioclase were mostly concentrated on the endmembers under the high-pressure conditions, thus there are few reports on sintering of plagioclase with intermediate composition.

In this study, sintering of labradorite polycrystalline were performed by using nanoscale powders of natural labradorite, and grain growth kinetics was studied in sintered polycrystalline labradorite. We prepared nanoscale mineral powders from natural crystals of labradorite (Ab38An62) by milling. Sintering experiments were carried out at a temperature of 1100-1210 ℃ with controlling time after milling and formed mineral powders. Starting materials were characterized by electron probe micro analysis (EPMA). The resultant materials were characterized by X-ray powder diffraction (XRD), secondary electron microscope (SEM) and Xray fluorescence (XRF) analysis.

Grain growth occurred with increasing sintering temperature or sintering time. The experimental data can be fit the following relation, $D_f{}^n$-$D_0{}^n$ = kt where n is a constant, D_f and D_0 are the grain size at time t = t and t = 0 respectively, and k is a rate constant. For sintering, a temperature of 1100-1210 ℃ with controlled time can provide high dense aggregates of labradorite with an average grain size of 0.5micro m, porosity of 3vol% and volume reduction of 60%. In this study, we found that high dense and fine grain polycrystalline Labradorite can be made from nano-sized powders (<100nm) by atmospheric pressure sintering.

Keywords: plagioclase, sintering, grain growth