

Synthesis of highly dense and fine-grained crustal and mantle mineral aggregates by spark plasma sintering (SPS) technique

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We will present the synthesis of various types of the upper mantle and crustal mineral aggregates including mono-phase aggregates of Fe-free and Fe-bearing olivine, enstatite (MgSiO_3) and anorthite ($\text{CaAl}_2\text{Si}_2\text{O}_8$), two-phase composites of olivine + spinel, olivine + diopside (CaMgSiO_6), olivine + enstatite and anorthite + diopside and three-phase composites of olivine + enstatite + diopside. We prepared mineral powders through solid state reaction of source powders at high temperature (Koizumi et al. 2010). They are densified by spark plasma sintering, which results in obtaining highly dense and fine-grained aggregates. In SPS, it is essential to use proper starting powders and sintering conditions such as temperature, duration time and heating rate. At low temperature of 1130 - 1250°C, short duration of 20 min and low heating rate of 10°C/min, we could obtain aggregates with grain size of 0.2 μm in minimum.

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