

Synthesis of highly-dense and fine fine-grained diopside, enstatite, forsterite, and olivine aggregates by vacuum sintering method

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Diopside, enstatite, forsterite, olivine, forsterite-enstatite-diopside powders with particle sizes of smaller than 100 nm were prepared by solid-state reaction of two different nano-powders of non-crystalline silica and highly dispersed $Mg(OH)_2$. Calcium carbonate ($CaCO_3$ purity was 99.0%) as the calcium (Ca) source, and iron acetate as the iron source were mixed with the nano-powders to obtain diopside and olivine phases.

The powders were mixed by ball-milling with more than 24 hours. The mixtures were then calcinated at 860-1050 degrees C for 3h to obtain fine-grained powders with expected phases.

We searched suitable temperature condition for these calcinations by scanning electron microscopy (SEM) and X-ray powder diffractometry (XRD). The calcinated powders were then pelletized by cold isostatic pressing (CIP) with water medium at 200 MPa. The pellets were sintered at 1280-1400 degrees C for 0-2h in a vacuum of lower than $2E-3Pa$.

Consequently, full density polycrystalline diopside, olivine, enstatite, forsterite with an average grain size of 0.3-4 μm were obtained.