

Synthesis of giant single crystals of silicate perovskite

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Large single crystals of MgSiO_3 perovskite were successfully synthesized by a thermal gradient method at 24 GPa and 1500°C. This was achieved by an improvement of high pressure synthesis technique that allowed us to grow single crystals under such ultra-high pressure conditions in relatively large volumes (e.g. 10 mm³). Since crystal growth is hindered by neighboring crystals, the nucleation density was suppressed by reducing thermal gradient to 20°C/mm, permitting an increase in free space for large crystal growth. KHCO_3 - $\text{Mg}(\text{OH})_2$ solvent can be used to grow perovskite crystals. However, the carbonate solvent produces melt inclusions. Silicate sources with MgSiO_3 composition produce stishovite inclusions, which in turn cause splitting of perovskite crystals. The formation of these inclusions is avoided by using H_2O as a solvent and 85 MgSiO_3 -15 Mg_2SiO_4 as a silicate source. The H_2O also allows homogeneous crystal growth, probably because of its low viscosity and high silicate solubility. High-quality single crystals larger than 1 mm were successfully synthesized through these technical developments.