

# **Sintering of submicron-grained pyroxene aggregates: for future measurements on its rheological properties**

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Mantle convection and large-scale plate motion depend critically on the rheological properties of its constituent minerals. Because olivine is the most abundant and the least viscous mineral under upper mantle conditions, rheology of olivine have been assumed to control the mantle flow behavior. However, this perspective might be incomplete because observations from some mantle xenoliths indicate that the recrystallized grain-size of orthopyroxene is quite smaller than that of olivine, and thus deformation might become localized in the fine-grained orthopyroxene bands. Therefore, orthopyroxene, the second most abundant constituent of the upper mantle, may play a significant role in constraining upper mantle viscosity under some circumstances, such as highly deformed regions like plate boundaries.

Although understanding of the rheology of orthopyroxene is of significant importance in exploring flow behavior of upper mantle, relatively little is known about its rheological behavior, especially at conditions where grain-size sensitive creep occurs. To quantify the grain-size sensitive deformation mechanism (e.g. diffusion creep) of orthopyroxene, it is important to fabricate fine-grained polycrystalline orthopyroxene. However, to reduce the average particle size down to  $<1 \mu\text{m}$  by mechanical milling is difficult.

In this study, I investigated a method for preparing submicron-sized powders from pyroxene single crystals. Single crystals were broken into millimeter-sized fragments and ground in an agate mortar. Then, they were milled by using a nano pulverizer with cooling system. The effect of milling conditions (e.g. ball-to-powder weight ratios, revolutions per minute) were examined. Finally, submicron-grained pyroxene aggregates were sintered from pulverized pyroxene crystals. This method might be useful for future measurements on its physical properties which will help to understand grain-size sensitive deformation mechanism of orthopyroxene.