Dr. Tetsuo Irifune
Director, Professor
Geodynamics Research Center

2021.12.24 (Fri.) 16:30 ~

Venue: Zoom

A link will be sent @grc-all within 30 minutes before the beginning of the seminar.

Transparent nano-ceramics

"Transparent ceramics" have advantages over corresponding single crystals in use as optical devices, because they are tougher and easier in making larger samples and in doping minor elements than single crystals. However, these transparent ceramics have mostly been limited to those made of crystals with cubic symmetry and hence optically isotropic nature, which minimize the scattering of light at the grain boundaries. Theoretical studies suggest that pore-free ceramics with grain sizes significantly smaller than those of wavelength of visible light can be transparent even if the crystals are of non-cubic crystallographic symmetry. Moreover, such ceramics are expected to become harder with decreasing grain size due to the Hall-Petch effect, particularly those in the nano-regime. Our group and the collaborators succeeded to synthesize well-sintered nano-ceramics by crystallization of glass under ultrahigh pressure and at high temperatures for stishovite, grossular, kyanite, cubic Si_3N_4, and jadeite using multianvil apparatus. Some of these nano-ceramics were found to be optically transparent and have peculiar features such as higher thermal durability and higher hardness as compared to those of the single crystals. Here I review ultrahigh-pressure synthesis of these transparent nano-ceramics. Features of these nano-ceramics, such as transparency, hardness, and other physical properties are also reviewed, although they have not yet been studied well and only a limited number of data are available to date.