

The 442nd Geodynamics Seminar

Pressure-assisted synthesis of transparent nano-crystalline ceramics

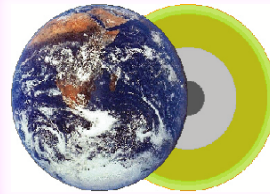
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Research Bldg. 1, Ehime Univ.

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場所 : 愛媛大学 総合研究棟 I
4階共通会議室



Abstract

Transparent oxide ceramics have been mostly synthesized at relatively low pressures, using Hot Isostatic Pressing (HIP) and Sparkling Plasma Sintering (SPS) techniques. However, synthesis of highly transparent ceramics with nano-crystals (<100 nanometers) has been difficult using these conventional sintering techniques, although it is predicted that the optical transparency and mechanical strength of such ceramics are significantly enhanced if transparent ceramics composed of nano-crystals without residual pores are available. We used Kawai-type multianvil apparatus and bulk glass starting material, and succeeded in synthesis of pore-free nano-polycrystalline grossular ($\text{Ca}_3\text{Al}_2\text{Si}_3\text{O}_{12}$) garnet in a limited temperature range around 1400°C and at pressures greater than 10 GPa under very dry conditions. Thus synthesized nano-polycrystalline grossular has optical transmittance almost equivalent to that of the corresponding single crystal (~88%) in the visible light region. Moreover, its hardness becomes higher with decreasing grain size by ~30%, particularly for the grain sizes less than 200 nm, showing that the Hall-Petch effect is valid in the nano-crystalline regime. The present pressure-assisted conversion opened the door to the synthesis of transparent nano-polycrystalline ceramics, which should be important for various applications in Earth and materials sciences.

詳細は当センターホームページ: <http://www.grc.ehime-u.ac.jp/> をご覧ください

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