The 404th Geodynamics Seminar

Synthesis of high-quality polycrystalline grossular garnet under high pressure and high temperature

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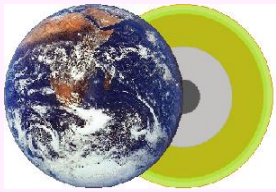

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Abstract

Garnet is one of the most abundant minerals in the Earth's upper mantle to the transition zone. Synthesis of well-sintered polycrystalline garnet is important for measurements of sound velocities by ultrasonic method. However, synthesis of high-quality polycrystalline garnet was difficult until a recent study on almandine by Arimoto et al. (in preparation), where well-sintered polycrystalline almandine samples with grain sizes of 2-3 μm were successfully made. In this study, synthesis experiments for grossular ($Ca_3Al_2Si_3O_{12}$) have been conducted at a pressure of 15 GPa and various temperatures in a multianvil apparatus. I used glass rods with a grossular composition as the starting material. In order to avoid the formation of cracks in the grossular sample, a heating procedure was adopted during pressure releasing. Highly transparent crack-free grossular was successfully synthesized at an unloading temperature of about 800 ℃. It was found that vertical cracks preferentially occur when the unloading temperature is higher than this temperature, while horizontal cracks were dominant at the lower temperatures. The effect of synthesis temperature on the grain size of grossular was studied by TEM and XRD observations. The transparent polycrystalline grossular samples were found to have grain sizes far smaller than 1 μm, depending on synthesis temperature. The successful synthesis of high-quality polycrystalline grossular is considered to be due to the absence of water in the starting material.

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