The 397th Geodynamics Seminar

Crystal growth process of ballas, a natural polycrystalline diamond

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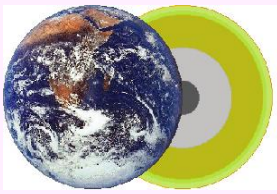

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Abstract

Ballas is a type of natural polycrystalline diamonds and shows a spherulitic morphology composed of radiating fibrous-columnar crystals. The crystallographic features of ballas has been studied by conventional XRD technique and described to be characterized by [110] or [111] elongation, but no direct observations have been performed to investigate the details. In this study, several natural ballas samples were examined by using electron backscattered diffraction (EBSD) and cathode-luminescence techniqueon their cross-sections to understand the crystallization process in the Earth's mantle. The results showed that individual fibrous-columnar crystals constituting a ballas are in contact each other by 10-40° misorientations, while a number of subdomains separated each other by low-angle (< 10°) misorientations are also present within the crystals. Despite the dominance of the misorientations, the pole-figure plots showed that the crystallographic orientation distribution in a ballas is, as a whole, rather "single-crystal-like". These results suggest that the crystal growth of ballas diamonds is initiated by a nucleation of seed crystals, followed by elongation and branching of columnar crystals to form a radiating morphology. During the latter process, crystals involve rotation and twisting along the elongation direction, which result in the observed low-angle misorientations. Such a growth process is probably achieved in the presence of C-H-O fluids which are highly supersaturated (compared with the growth condition for single-crystal diamond) with respect to diamond in the mantle.

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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