Geodynamics Seminar

第317回ジオダイナミクスセミナー

Phase stability of boron relative to beta-boron at HPHT

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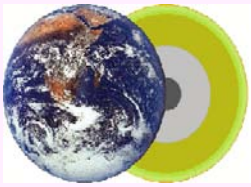
主催：愛媛大学地球深部ダイナミクス研究センター
日時：2/10（金）午後 4時30分～
場所：総合研究棟 4F 会議室



EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER

Abstract

Boron has been widely studied due to its complex polymorphism and fascinating chemical and physical properties. All known structures of boron and some boron-rich compounds contain B_{12} icosahedron, which can be flexibly linked into rigid framework structures. Many previous studies of boron concentrated on the synthesis and structural characterization of pure forms. Now probably four of the reported boron phases correspond to the pure element.:α-rhombohedral B_{12} (α-B_{12}), β-rhombohedral B_{106} (β- B_{106}), β-tetragonal B_{192} (T-192), and γ-B_{28}, but α-tetragonal B_{50} (T-B_{50} or T-B_{52}) is also believed to exist. However, the relative stability of boron phases is still experimentally unresolved at high pressure and high temperature. So we studied the phase relations in boron at high pressure and high temperature (HPHT) using a multianvil apparatus. We demonstrate that γ-B_{28} can be synthesized over a wide P-T range, and T-B_{50} is obtained at higher temperatures and similar pressures. The phase boundary of the β-B_{106}, γ-B_{28} and T-B_{50} is determined at pressures between 7 and 18 GPa and the temperatures of 500-2200 ° C. The results suggest that T-B_{50} might be an intermediate phase-formed for kinetic reasons (Ostwald rule) on the way from β-B_{106} to T-192 and γ-B_{28} to T-192. Understanding the hardness and elastic properties of hard materials is important for industrial and/or scientific use. To verify the mechanical properties of polycrystalline boron, here we present the sintered of the nearly full-densified phase-pure beta- and gamma-boron compacts at HPHT. The Vickers hardness of polycrystalline boron was tested with a larger applied load up to 10 N. In addition, we also investigated the elastic moduli of the samples using an ultrasonic method.

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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