New Bulk Superhard Semiconducting C-B Composite

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A bulk composite material has been synthesized from graphite-like BC₃ at 20 GPa and 2300 K using a multianvil press in the form of well-sintered 8-mm³ cylinders. The material consists of intergrown boron carbide B_4C and boron-doped diamond with 1.8 at% B. The material exhibits semiconducting behaviour and has hardness comparable with that of single-crystal diamond. Synthesis of composite ceramics with hardness approaching that of diamond suggests that new superhard materials could be not only among monophases. Combination of semiconducting properties and extreme hardness makes the synthesised material potentially important for precision (for example, electroerosion) machining, electrochemical, and electronic (high-power, high-frequency) applications.