研究論文

単結晶ダイヤモンド基板上へ合成した CVD ホウ素ドープダイヤモンドの構造評価

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Structural Evaluation of the CVD Boron Doped Diamond Synthesized on the Single Crystal Diamond Substrate

by

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(Received Jan. 26, 2018; Accepted Mar. 2, 2018)

Abstract

Single crystal Boron doped diamond(BDD) is expected to applied to industry such as the precision cutting tools, the ultra-precision measuring styluses and the wear resistant. However, commercial BDD is polycrystalline, then single crystal BDD was solely reported as preparations of thin films and particles. Therefore, it is important to obtain bulk BDD and establish synthesis technology of the bulk single crystal BDD.

In this paper, investigation was carried out on the structural evaluation of BDD synthesized on single crystal diamond substrate using Chemical Vapor Deposition(CVD-BDD). The underneath surface of CVD-BDD was exposed using plasma etching method, and the cross-section was formed by laser cutting then polishing its surface. CVD-BDD was evaluated by SEM, Raman spectroscopy and Laue back reflection method. As a result of the plasma etching process, amorphous carbon and polycrystal BDD were etched from the surface of CVD-BDD. The peaks of high Boron inclusion diamond and no amorphous-carbon were observed in the Raman spectra. In the Laue pattern, cleary Laue-spot were obtained. In addition, Halo-pattern and Debye-Scherrer ring were not observed.

Keywords: Single crystal growth, Boron doped diamond, Inductively coupled plasma, Plasma etching, Laser cutting

1. 緒言

ダイヤモンドは，物質中最高の硬度を有すことから工具や耐摩耗部材としての利用，高い熱伝導特性を利用したヒートシンクへの適用，赤外から紫外までの領域で比較的広い波長領域において高い透過率を有すことから窓材への応用など，工業界で広く用いられている．また電気特性としては通常 10^{16} Ω･cm 程度の体積抵抗率を示す絶縁体だが，ホウ素（B）をドーピングすることで P 型半導体化が可能であり，B ドーピング濃度を変化させることで電気伝導度の制御が行われている [1), 2)]．電気伝導性を付与した B ドープダイヤモンド（BDD）は，電位窓が広く，バックグラウンド電流が極めて低く，地球上のどの様な溶液にも不溶である化学安定性などの電気化学的特性から，電解合成や生体関連物質および環境汚染物質などの測定用電極としての応

平成 30 年 1 月 26 日受付

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