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Growth of Cubic Boron Nitride by Electron Cyclotron Resonance Chemical Vapor Deposition on Boron Doped Diamond Substrates

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Cubic boron nitride (c-BN) is an ultrawide-bandgap semiconductor with a 6.4 eV bandgap, a high breakdown field above 15 MV/cm, and great thermal conductivity of 940 W/m·K. This makes it excellent for the next generation high-power and high-temperature electronic devices. In this work, we report the growth of c-BN using a custom-built Electron Cyclotron Resonance Chemical Vapor Deposition (ECR-CVD) reactor. Energy-dispersive spectroscopy (EDS) revealed a B/N ratio of approximately 1:1, consistent with that of reference bulk c-BN crystals, confirming the presence of boron nitride. Fourier Transform Infrared (FTIR) measurements represent clear features corresponding to the reststrahlen band of cBN, with initial evidence of the responsible phonons at 1050cm-1and 1305cm-1 through Raman spectroscopy. Some samples show a mixture of c-BN and h-BN, while most are single-phase c-BN. Capacitance measurements indicated a film thickness of 0.1–0.3 µm, consistent with the results obtained from atomic force microscopy (AFM). Boron Doped Diamond Substrate is ideal for c-BN growth, but its strong Raman signals hinder BN phase analysis, underscoring the need for Cathodoluminescence (CL) mapping. CL imaging distinctly resolved h-BN and c-BN grains of around 20 µm, identified by their characteristic sub-bandgap emissions near 330 nm and 470 nm, respectively.

Academic or Professional Status

Graduate Student

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