Contribution ID: **58** Type: **ORAL**

Dielectric Properties of Conducting Boron-Doped Diamond

Wednesday, April 1, 2026 3:25 PM (20 minutes)

We extract the infrared dielectric function from Fourier transform infrared reflectance spectra 650–4000 cm−1 for conducting single crystal and polycrystalline boron-doped (3–6×1020 cm−3) diamond (BDD) by Kramers–Kronig (K–K) analysis, validating our method on commercial SiC substrates. This method highlights the importance of using integrable functions in K–K, solving issues with convergence near the endpoints of the measurement spectral range. Polycrystalline BDD shows an elevated optical index ~3–3.5 below 2000 cm−1 compared to the ~2.5–2.7 in single-crystal BDD, and the ~2.4 for ideal diamond, accompanied by increased dielectric loss at ~1250 cm−1, termed the L2-mode. Raman mapping of this IR-active ωL2 revealed elevated levels of graphitic sp2 inclusions, particularly at grain boundaries. These optical measurements are consistent with polycrystalline BDD showing lower electrical resistivity 0.05Ω-cm, one order lower than that of the single crystal 0.6Ω-cm, highlighting the strong role of sp2 inclusions in grain boundary conductivity as a source of dielectric loss. These results show that extrinsic factors beyond B-doping alone should be considered in the interpretation of the optoelectronic properties of BDD and inform its use for thermal management in codesigned microelectronics for power and RF systems, plasma-assisted epitaxy of cubic boron nitride and electrochemistry.

Academic or Professional Status

Graduate Student

Author: HARRISON, Daniel (Morgan State University)

Co-authors: Mr RAIHAN, Ahamed (Morgan State University); Mr DZOTCHA KENGNE, Astrid (Morgan State University); Dr THOMAS, Christopher (Widetronix); Dr SIMIN, Grigory (University of South Carolina); Dr BURROW, Joshua (Morgan State University); Dr CHANDRASHEKHAR, MVS (Morgan State University); Mr ALAM, Md. Jahangir (Morgan State University); Dr SPENCER, Michael (Morgan State University)

Presenter: HARRISON, Daniel (Morgan State University)

Session Classification: Technical Session 2

Track Classification: Materials & Devices: Materials & Devices - (b)