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The Negative Electron Affinity Effect on the Thermionic Emission from Nitrogen Doped Diamond YINGJIE TANG, FRANZ KOECK, ROBERT NEMANICH, North Carolina State University, NORTH CAROLINA STATE UNIVERSITY TEAM — The thermionic emission properties of microwave CVD nitrogen doped diamond films with a negative electron affinity (NEA) were investigated with thermionic emission spectroscopy (TES) and UV photoelectron emission spectroscopy (UPS). At a temperature of 230°C thermionic electron emission was observed with a current density $\sim 1\text{nA}/\text{cm}^2$ and a minimum kinetic energy of 1.6eV relative to the Fermi level. Both the thermionic and photoemission spectra display the same sharp cutoff edge corresponding to the conduction band minimum (CBM) which is detected because of the NEA properties of films. With increasing temperature, electron emission is observed below the CBM which is attributed to tunneling phenomena from nitrogen related states and sp² bonded defects. The emission extends to $\sim 1.3\text{eV}$ below the conduction band which would be consistent with prior measurements of the negative electron affinity of diamond surfaces. The effect of the NEA on space charge and defect related electron emission is also discussed.

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