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Novel Approaches in Energy Conversion by Molecular Charge Transfer from Diamond Surfaces[1] FRANZ A.M. KOECK, Arizona State University, JEFF SHARP, Marlow Industries, Inc, ROBERT J. NEMANICH, Arizona State University — Vacuum thermionic energy conversion is based on electron transfer from a hot emitter across a vacuum gap to the collector. Our approach for an efficient emitter utilizes nanostructured, negative electron affinity doped diamond films. With a low effective work function of less than 1.3 eV thermionic emission commences at 260 C and observes the law of Richardson – Dushman with a significant emission current > 5 mA at 500 C. Pairing this emitter with a similar collector results in a potential across the gap and introduction of an ohmic load establishes a current indicative of energy conversion. Utilizing ionization processes of gaseous species at the emitter surface can enhance inter-electrode charge transfer and increase output power. In the ionization process an electron is trapped in an occupied molecular orbital establishing a negative ion state. The electron affinity and negative ion binding energy determines stability of the transient negative species, and we present results for H2 and CH4. As these species are introduced in the inter-electrode gap an increase in output power is observed with a concurrent shift of maximum output power to lower load resistance.

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