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Applying CVD Diamond and Particulate Nanodiamond

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Nanometer scale diamond tip emitters for cold cathodes are being developed as (a) vertical and (b) lateral diamond vacuum field emission devices. These diamond field emission devices, diode and triode, were fabricated with a self-aligning gate formation technique from silicon-on-insulator wafers using variations of silicon micropatterning techniques. High emission current, > 0.1A was achieved from the vertical diamond field emission diode with an indented anode design. The gated diamond triode in vertical configuration displayed excellent transistor characteristics with high DC gain of ~800 and large AC output voltage of ~100V p-p. Lateral diamond field emission diodes with cathode-anode spacing less than 2μm were fabricated. The lateral diamond emitter exhibited a low turn-on voltage of ~5V and a high emission current of 6μA. The low turn-on voltage (field ~ 3 V/μm) and high emission characteristics are the best of reported lateral field emitter structures.

We are also examining particulate nanodiamond for thermal conductivity enhancement of dielectric oils. We have observed that a dispersion of nanodiamond (particle size circa < 5nm) can increase the overall thermal conductivity of cooling oils such as used in power transformers by over 25%.