Crystallume
Engineered Diamond Products
A Division of RobbJack Corporation

GaN-on-Diamond Substrates for HEMT (High Electron Mobility Transistor) Applications

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Why GaN ……..

Unlike silicon, gallium arsenide, silicon carbide and indium phosphide, only GaN can manage both high speeds and high signal purity at high power. These characteristics make GaN the ideal "super transistor."

Nitronex

……..on Diamond for HEMT

- Phenomenal thermal conductivity of diamond, for heat management
- Combine the most dynamic of III-V materials, with possibly with the most dynamic material known ~ get “super cool transistor”!

Why GaN on Diamond for HEMT

- Performance of transistors is limited by fundamental material properties.
- Power and frequency limits in analog amplification are expressed concisely with Johnson Figure-of-Merit[1] used in the industry since 1965 for relative comparison between different materials.
- The higher the JFM number the better!

For a HEMT, Johnson Figure of Merit (JFM) is proportional to the product of transit-time cutoff frequency f_t and maximum RF power $P_{\max}$ that can be delivered by the device[2].

$$JFM \equiv \left(\frac{v_S E_B}{2\pi} \right)^2 \propto P_{\max} f_t$$

E_B is breakdown electric field
v_S is the saturated drift velocity