DMD signs up leading processing firm, INEX, to develop fabrication technology for its novel electronic devices.

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Diamond Microwave Devices (DMD), a subsidiary of Element Six Ltd (E6), has signed a contract with INEX to provide the processing technology for its electronic component development programme. DMD is working on the next generation of high-power, high temperature semiconductor devices for microwave power electronics. The agreement marks the next important step in the development of electronic devices fabricated in single crystal diamond synthesised using chemical vapour deposition (CVD).

In December 2006, E6 signed a collaboration agreement with Filtronic to work with its new subsidiary, DMD, on diamond-based microwave devices. The two companies are combining their strengths in materials, semiconductor devices and circuit design to create novel diamond devices that could transform microwave power electronics.

Based within the University of Newcastle, INEX is one of the UK's leading research and commercialisation centres for microsystems and nanotechnologies. INEX will work closely with DMD, E6 and Filtronic to develop new processing techniques and to fabricate prototype devices based on the E6 proprietary diamond material and a device design as provided by Filtronic. INEX is a specialist in emerging technologies such as microelectromechanical systems (MEMS) and nanotechnology. The facility has benefited from major government investment programmes (European Commission, Department of Trade and Industry, and Regional Development Agency ONE NorthEast), making it one of the most advanced of its type in the UK. In late 2004, it became the first of the government's national Nanotechnology Centres, acting as a contract manufacturer, performing multimaterial processing on platforms up to 150 mm.

Ambitious goal set

The goal is to exploit the exceptional properties of CVD diamond as an advanced engineering material. Initially, the aim is to demonstrate a practical MESFET (metal semiconductor field effect transistor) using CVD diamond grown by E6, and providing useful power at microwave frequencies. "The impressive facilities and expertise within E6, Filtronic and INEX should help us achieve our ambition of creating diamond MESFETs that could revolutionise the design of future microwave power modules," says Dr Richard Lang, General Manager of DMD.

"We believe that this marks an important step for INEX. The collaboration with DMD gives us the opportunity to work at the cutting edge of next generation technology," says Professor Ken Snowdon, Managing Director at INEX.

Device potential

The MESFET has been identified as one of the most promising devices to be constructed in CVD diamond. Though there are many technical hurdles to overcome, diamond material offers the ability to operate at higher temperatures and higher breakdown voltages than conventional

semiconductors. As an intrinsic material, diamond demonstrates extreme hardness, chemical inertness, high thermal conductivity, high hole and electron mobility, high dielectric strength, high breakdown strength and wide band gap. When compared to competing materials for use in electronics including silicon and gallium arsenide, the intrinsic properties of single crystal CVD diamond are clearly superior for applications where there are extreme demands.

In recent years, E6 has made considerable progress in the synthesis of diamond using CVD processes because it allows single crystal forms of diamond to be manufactured to the high purity and consistency demanded of electronics applications. DMD hopes that it can use this material as a basis for a family of microwave devices that will offer new levels of performance in a range of commercial applications from mobile to satellites.

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