The MIDDI Project

The Micromachined Diamond Device Initiative (MIDDI) is focused on the development of a 'tool-kit' of advanced micro- and nano-scale manufacturing technologies for next generation high-frequency and high-power electronic devices based on synthetic single crystal diamond. Novel diamond electronic devices are expected to have a range of applications in communications and power switching.

Meeting the challenge of electronic devices

For E6, a world leader in the manufacture of synthetic diamond, the challenge has been to refine and develop its processing technology to create the platform to make active electronic devices. Diamond is one of the most difficult materials to process especially in relation to using it to fabricate semiconductor devices. "E6 has already established a world leading position in the synthesis of electronic grade diamond," says Christopher Ogilvie Thompson, the company's Commercial Development Manager. "Single crystal diamond synthesised by chemical vapour deposition has opened the way for very precise device structures to be made."

The heart of the work at E6 involves making nanoscale layers of diamond with high precision, and this depends on a number of complex processing and synthesis steps. For a high frequency active electronic device, some of the individual layers are required to have thicknesses of a few nanometres. In addition, these layers need to be atomically smooth, and have extremely sharp doping profiles. Recent work under MIDDI has lead to considerable progress in developing the required tools.

The role of the Institute of Photonics at the University of Strathclyde is to provide the expertise in plasma etching technology, which is used to define the precise surface features required in device fabrications. Established in 1995, the Institute has become a centre of expertise in etching materials that have traditionally been difficult to process, such as diamond.

At the time MIDDI was initiated, two key application areas for this new fabrication technology had been identified: high voltage switching for the power industry, and compact, high power, solid state radio frequency devices for future satellite communications and digital television broadcasting replacing the vacuum tubes currently in use.