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Firm has technology for diamond-based electronics

by Steve Bush
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Berkshire-based Element Six has demonstrated a diamond 'delta layer' thought to be necessary for commercial diamond electronics.

"The layer is an enabling technology," R&D manager Geoff Scarsbrook told *EW*. "Once you can do this, you can make devices."

Intrinsic, undoped diamond is desirable for its high carrier mobility, but it has no carriers.

"If you try to dope it with boron, you either don't get enough carriers, or you get the carriers but the mobility is no longer good enough," explained Scarsbrook.

A delta layer is a thin, heavily doped layer which provides carriers for adjacent high-purity material.

"We have boron-doped delta layers which are about 5nm wide and which show very sharp edges, with a 1nm/decade rise in concentration from 10^{16} atoms/cm^3 or less, up to in excess of 10^{20} atoms/cm^3," said Scarsbrook.

"This peak concentration is needed to generate sufficient carriers at room temperature, and the sharp interface to high purity material is necessary to let these carriers diffuse into the pure un-doped diamond where their mobility is very high," he added.

The interfaces are also very smooth. "The surfaces have an RMS roughness of less than 0.2nm," said Scarsbrook. "This is required so that the above delta layers do not have significant steps in them, which would scatter the carriers."

The research is part of the Micromachined Diamond Device Initiative (MIDDI) Project, led by researchers at Element Six in collaboration with the Institute of Photonics at The University of Strathclyde.

MIDDI's aim is to develop a tool kit of manufacturing technologies for high-frequency and high-power electronic devices based on synthetic, single-crystal diamond.