Two Contracts Move Closer the Prospect of Single Crystal Diamond Transistors

Diamond Microwave Devices Ltd, DMD, has won a contract from MBDA, Europe's leading missile systems company, relating to the development of a transistor based on single crystal synthetic diamond material. At the same time, DMD has placed a contract with the London Centre for Nanotechnology, part of University College London, UCL, to help it with studies related to diamond's electronic properties.

DMD, a subsidiary of Element Six which is the world leader in the production of all forms of synthetic diamond for industrial use, is actively working on a new generation of electronic components based on diamond rather than silicon. This work moves the prospect of active switching needed for RF components closer to reality. "The work will be to investigate the mobility of delta-doped chemical vapour deposition (CVD) diamond and to apply the results within a 2D physical model for a diamond transistor," explains Richard Lang, general manager of DMD Ltd.

An MBDA spokesman commented, "The achievement of semiconductor operation in diamond offers a new class of thermally robust microwave components. It provides the potential to reduce the cost of ownership and improve the reliability of RF systems."

Delta doping is a technique that has been proposed to enable active electronic devices such as MESFETs (MEtal Semiconductor Field Effect Transistors) to be fabricated in diamond. In this technique, a thin layer of highly boron-doped diamond buried within the intrinsic diamond donates carriers (holes) to create a conduction channel between the metal source and drain. Such a design approach is needed because only p-type dopants are currently feasible for diamond and so efforts have been focused on novel structures that can create the active switching needed for transistor function taking into account this factor.

DMD's contract with the London Centre for Nanotechnology is to investigate mobility of delta-doped material. Mobility gives a measure of the efficiency of a transistor's function and the study will give an indication of diamond's possible performance as an active device. The London Centre for Nanotechnology is a multi-disciplinary organisation at the cutting edge of science and technology that is involved with research at the nanoscale.

Richard Jackman, who will lead the research at the centre, says, "Diamond offers enormous potential for high performance devices, but brings with it some challenges that are new to the electronics sector. The experience within DMD, when allied to the broad range of capabilities of the London Centre for Nanotechnology, makes this exciting collaboration unique in the world."

Both contracts have been made possible by funding from the Research Acquisition Organisation, RAO, which is part of the Ministry of Defence. The funding is within the Electronics Systems Research programme that is responsible for cutting edge research into the key underpinning technologies in electronic and opto-electronic systems that are used throughout MoD in equipment and operations.

DMD was set up in late 2006 with the aim of creating the next generation of high power, high temperature semiconductor devices based on single crystal CVD diamond for use primarily in microwave power amplifiers and transmitters that are used in a broad range of applications spanning electronic defence and communications.

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