**DEPARTMENT OF ELECTRONIC &
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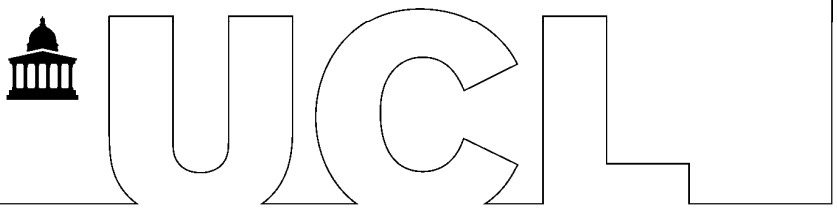

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PAPER TITLE: Delta-Doped Diamond Structured for High Performance Transistor Applications

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ABSTRACT:

Diamond has great potential as a semiconducting material, it is a wide band-gap semiconductor with comparable properties to silicon carbide or gallium nitride. It could however far surpass these in terms of carrier mobility, saturation velocity, high power and high temperature capabilities. In fact if some hurdles could be overcome it could be the perfect semiconducting material for high performance device manufacture.

One major limitation in diamond however is its lack of an available shallow dopant. This presentation explores diamonds promise through a novel doping method known as 'delta-doping'. Beginning with analysis of the latest 1 nm boron doped delta layers grown by Element 6, via hall effect measurement and impedance spectroscopy.

It also shows one of many potential applications in the form of the ion sensitive field effect transistor (ISFET). Some work has already done in this area in producing a functional although limited ISFET on a delta-doped 5 nm diamond sample, capable of measuring pH in a harsh environment.

Work was continued in this area in to refining the ISFET structure, creating a mesa structure on the diamond surface to isolate the transistor channel and hopefully improve the performance and push it in to saturation. Several designs were fabricated with some on capped (intrinsic diamond-boron-intrinsic diamond sandwich) and some on uncapped (intrinsic diamond-boron exposed layer) substrates. Details of both fabrication, characterisation and possible improvements of these will be discussed.