From labs to pilot lines: Graphene and related materials device fabrication solutions

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Extensive efforts in the research and development of graphene-based technologies over the last 15 years has resulted in steady increase in technology readiness. Today, we see an emergence in efforts for development of graphene-based applications (such as modulators, detectors, gas and biosensors) at scale. For successful scaling up of prototypical applications demonstrated to date, robust technologies, and processes for large area device fabrication are required.

Traditionally, plasma-based processing has been thought of as too harsh to achieve high-quality graphene devices, as any ion/radical interaction with the graphene surface can result in physical damage to the 2D hexagonal structure. In contrast pure thermal deposition of dielectrics suffer from lower film quality and nucleation challenges. In this work, we show that remote plasma techniques enable the deposition of high-quality thin layers of Al_2O_3 on single layer graphene using either transferred hBN or an in-situ deposited seed layer, with negligible damage. Furthermore, utilising plasma enhanced techniques broadens graphene applications to thermally sensitive substrates/devices expanding the range of potential applications for graphene based electrical devices.

In this talk I will first give an overview of lab & fab technologies developed at Oxford Instruments and collaboration partners towards growth of Graphene, other layered materials and heterostructures by CVD and ALD followed by our developments in technology for device fabrication processes such as dielectric deposition by ALD and device pattern etching by RIE and ALE.