

## Commercialising CNTs, Graphene and other 2D Nanomaterials: From the Academic Lab to the Marketplace

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### Abstract

Thomas Swan Advanced Materials division is dedicated to the supply of high performance materials which deliver value for our customers in new and emerging technologies, from printable electronics and memory devices to advanced coating and composite systems. We were early investors in carbon nanotubes in collaboration with the University of Cambridge, UK and are now a world leading supplier of high purity single-wall carbon nanotubes (Elicarb<sup>®</sup> SW).

More recently, in collaboration with Trinity College Dublin, Ireland, we have developed a novel scalable method for exfoliating graphite in liquids to give large-volume dispersions of graphene nanoplatelets.<sup>1</sup> The shear-exfoliation process operates under ambient pressure and temperature conditions, involves no aggressive intercalating and/or oxidation chemistries and is amenable to a wide range of solvent/graphite systems. As such, the product is a pristine, high conductivity graphene nanoplatelet material which is now commercially available in both powder format and as a surfactant stabilised aqueous dispersion (Elicarb<sup>®</sup> Graphene). Thomas Swan & Co. Ltd. has engaged numerous partners in application development programmes with this material, targeting a range of technologies including printed electronics, energy storage and capacitive touch sensors. As of early 2016 we will have a production capacity of 15 tonnes per annum of exfoliated 2D nanomaterials.

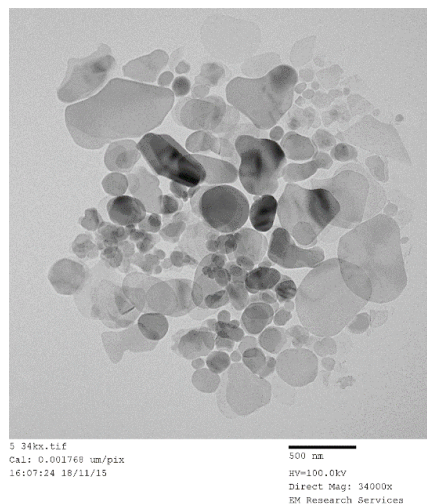
A further extension of the novel exfoliation process allows access to a wide range of newly emerging 2D advanced materials. In early 2016, Thomas Swan launched a new exfoliated 2D hexagonal boron nitride (h-BN) product. The dielectric nature of h-BN, coupled with high thermal conductivity, good barrier properties, high thermal and chemical stability, and mechanical strength in keeping with that of graphene, promises a wide variety of applications which include thermal interface materials in electronics and gas barrier in coatings and plastics.

This talk will provide an overview of our CNT and graphene products, processes and emerging applications. Further, there will be a focus on our newly emerging h-BN material and the next generation of 2D nanomaterial products.

### References

[1] Paton, K. *et al.* , Nature Materials, **13** (2014) 624.

### Figures



TEM image showing few layer h-BN Nanoplatelets from Thomas Swan's liquid exfoliation process