**Multifunctional Composites Based on Nanocarbons**

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## Abstract

This talk starts with a review of the different strategies to incorporate nanocarbons (CNTs, graphene) in polymer matrices and their relative merit in terms of mechanical reinforcement, improvement in electrical/thermal conductivity and emergence of other functional properties, such as sensing capabilities [1] [2]. Three types of nanocomposites are discussed: the first type corresponds to composites where the nanocarbon is used as a filler added to a polymer matrix, the second consists of hierarchical composites with macroscopic fibres and nanocarbon in a polymer, typically thermosetting matrix; the third type are nanocarbon-based macroscopic fibres which can be processed to form standard fibre reinforced polymer (FRP) composites (Figure 1). We then show examples of experimental results of low volume fractions nanocomposites with a high level of reinforcement and a significant increase in thermal conductivity. The effects of the nanofiller on the matrix are particularly noticeable in the low volume fraction regime; in this work we use by Raman spectroscopy to study the stress-transfer between nanocarbons and the matrix, and the possible residual strains in the composites due to mismatch in coefficients of thermal expansion. The stiffening of the polymer through reduced mobility and its increase in thermal stability are analysed by standard DMA and related to results obtained using a state-of-the-art nanoindentation DMA system.

## References

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## Figures

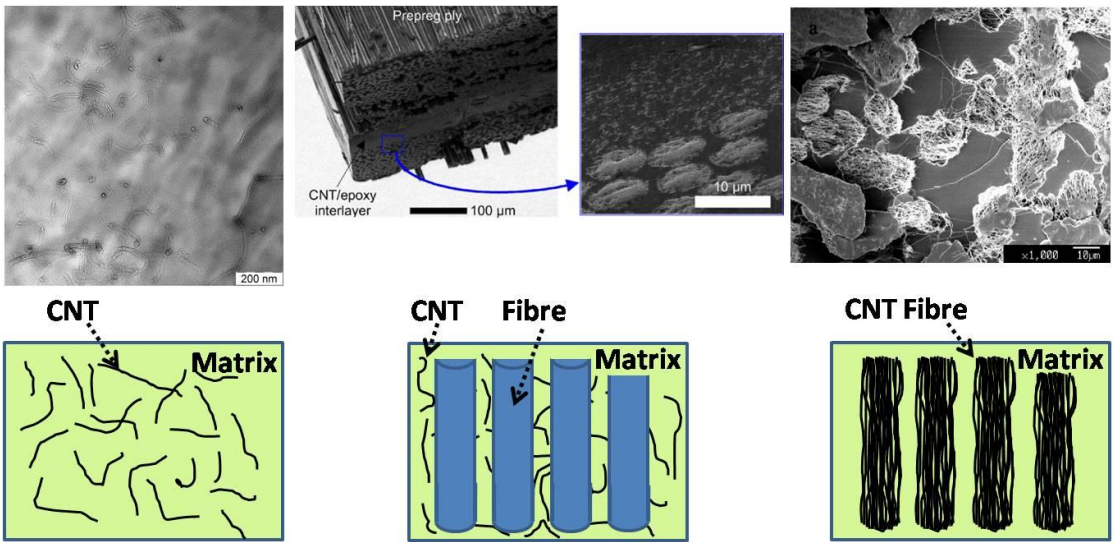


Figure 1. Electron micrographs of different nanocarbon composite types (top) and their schematic representation (bottom). Micrographs from references [3] [4] [5].