VIDEO ARTICLE

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# Structural and Chemical Analysis of Filled Nanotubes

**Francis Leonard Deepak**

Nanostructured Materials Group, International Iberian Nanotechnology Laboratory, Avenida Mestre Jose Veiga, Braga 4715-330, Portugal

Corresponding author: E-mail: leonard.francis@inl.int

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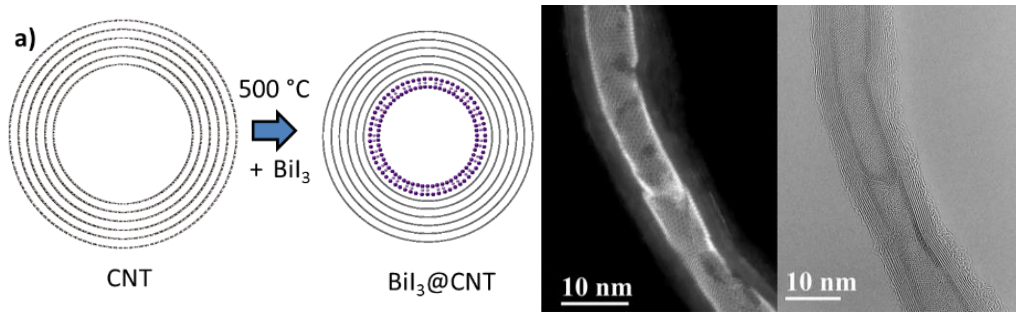
## Graphical Abstract




## Abstract

The hollow interiors of nanotubes could host the growth or filling of foreign elements/compounds to obtain hetero-structures. The growth of these materials in the confined one dimensional space lead to novel properties. There are different routes to obtain the filling of nanotubes. Among these capillary filling serves as a suitable method to enable filling of carbon nanotubes (CNTs) and inorganic nanotubes including those of BN and $WS_2$ [**1,2**]. In this talk the synthesis, structure and novel properties/applications of such 1D vdW heteronanostructures will be discussed. Various suitable examples will be highlighted. These include our recent work on the filling of Gd and Bi-based compounds within CNTs and $WS_2$ Nanotubes which enable the formation of Single-Walled Nanotubes of $GdI_3$ and $BiI_3$ [**3,4**]. The formation of Inorganic Single-Walled Nanotubes is especially interesting since it enables the exploration of new materials which are at the interface of 1D and 2D [**5**]. In such complex heterostructures, the precise determination of the structure and composition is detrimental in its further application. Thus the investigation of the structure, morphology and chemical composition of filled nanotubes investigated using aberration corrected scanning/transmission electron microscopy and associated spectroscopic techniques (EELS and EDS) will be outlined. The three dimensional structure of such systems can be elucidated using electron tomography [**6**]. The experimental observations in these systems are adequately supported by carrying out theoretical calculations in order to elucidate and understand the difference in behavior of the various compounds towards their affinity to fill the interior of the Nanotubes [**7,8**].

**Keywords**: One-dimensional; nanotubes; vdW heterostructures, inorganic single-walled nanotubes, advanced electron microscopic techniques.

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