NUMERICAL SIMULATIONS OF THE GROWTH OF SWCNTs IN PLASMA SYSTEMS

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Single walled carbon nanotubes (SWCNTs) are currently of enormous research interest due to the many potential uses they have as a result of their unique chemical, mechanical and electronic properties. Fabricating long VASWCNTs however, still prove to be a challenge. VASWCNTs typically can only be grown to a certain height depending on the system used.[1] It is generally believed that such limitation is due catalyst poisoning and solutions that have been offered involve mostly chemical means.[2] Whilst such methods do increase the maximum lengths of the grown VASWCNTs, the growth of the VASWCNTs still slows down over time and eventually stops thus reducing the achievable lengths of the nanotubes.

More importantly, the electrical properties of SWCNTs are well known to be mostly dependent on their chiral numbers, the control of which still remains a major a challenge. Ideally, selection of the SWCNTs should occur during the growth stage since this approach completely removes the need for additional processes to filter out unwanted SWCNTs and thus reduces the additional costs associated with longer processing times and wasted resources.

In this presentation, multi-scale numerical simulations are used to determine the effects of different plasma parameters on the growth of arrays of VASWCNTs with different diameters. It is shown that plasmas can be used to control the lengths of VASWCNTs and fabricate them at much higher rates compared to the equivalent neutral gas systems.[3,4] More importantly due to the higher relative growth rates, such plasmas can be used to grow thinner nanotubes faster and thus effectively 'drown out' larger-diameter nanotube providing some means of the selective growth of thin SWCNTs. This in turn would limit the types of chiralities that develop in the system thus providing new effective means of selecting the chirality of the single-walled nanotubes during the growth stage.

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