

Nano Seminar

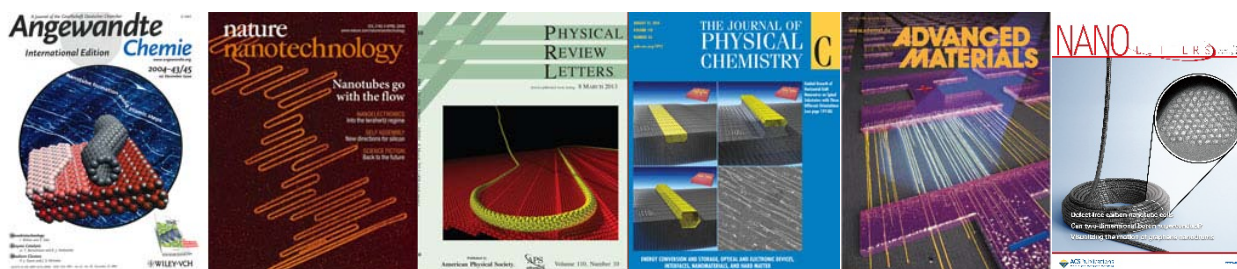
Shaping Nanotubes and Nanowires with Surfaces

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Abstract:

Molecules The large-scale assembly of nanotubes (NTs) and nanowires (NWs) with controlled orientation on surfaces remains one challenge toward their integration into practical devices. Following our earlier work on the guided growth of carbon nanotubes, we reported the vapor-liquid-solid growth of perfectly aligned, millimeter-long, horizontal NWs of GaN [1], ZnO [2] and other materials [3] with controlled crystallographic orientations on different planes of sapphire, SiC [4], quartz [5], and spinel [6]. The growth directions and crystallographic orientation of the NWs vary with each surface orientation, as determined by their epitaxial relationship with the substrate, as well as by a graphoepitaxial effect that guides their growth along surface steps and grooves. We also demonstrated the feasibility of massively parallel “self-integration” of NWs into circuits via guided growth [7], including hundreds of single-NW based field-effect transistors made all at once, and complex logic circuits, such as a 3-bit address decoder. Here we demonstrate the generality of the guided growth phenomenon to a variety of semiconductor materials with different optical, electronic and optoelectronic properties, as well as to interesting types of substrates. Lastly, we also show how surfaces induce the spontaneous self-organization of carbon nanotube coils, which could be used as electromagnets and dynamos [8]. These findings highlight the potential of guided growth as a general approach for the large-scale integration of NTs and NWs into a wide range of functional systems.



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- [2] D. Tsvion, M. Schwartzman, R. Popovitz-Biro, E. Joselevich, *ACS Nano*, **6**, 6433 (2012).
- [3] E. Oksenberg, R. Popovitz-Biro, K. Rechav, E. Joselevich, *Adv. Mater.*, **27**, 3999 (2015).
- [4] D. Tsvion, E. Joselevich, *Nano Lett.*, **13**, 5491 (2013).
- [5] L. Goren-Ruck, D. Tsvion, M. Schwartzman, R. Popovitz-Biro, E. Joselevich, *ACS Nano* **8**, 2838 (2014).
- [6] D. Tsvion, E. Joselevich, *J. Phys. Chem C* **118**, 19158 (2014).
- [7] M. Schwartzman, D. Tsvion, D. Mahalu, O. Raslin, E. Joselevich, *Proc. Nat. Acad. Sci. USA*, **110**, 15195 (2013).
- [8] N. Shadmi, A. Kremen, Y. Frenkel, Z. J. Lapin, L.D. Machado, S.B. Legoas, O. Bitton, K. Rechav, R. Popovitz-Biro, D.S. Galvão, A. Jorio, L. Novotny, B. Kalisky, and E. Joselevich, *Nano Lett.* **16**, 2127 (2016).

Gathering & Refreshments at 10:50

Please contact Liron Dover at 6584919 if you are interested in meeting the lecturer.

Sunday, May. 8th 2016, 11:00 at the Seminar Hall
Los Angeles Building, entrance floor.