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CINT Monthly

High-Impact Science Highlights: Enablers & Cross-cutting.

"Critical Role of the Sorting Polymer in Carbon Nanotube-Based Minority Carrier Devices," in *ACS Nano* ***(CINT NPON Thrust)***

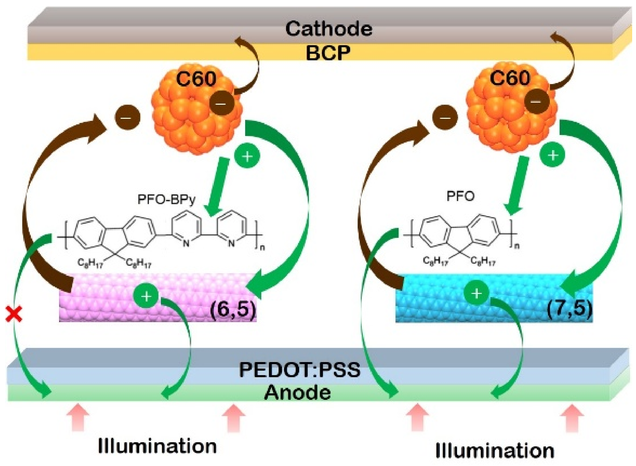


Figure 1: Dependence of critical device parameters on the content of sorting polymer

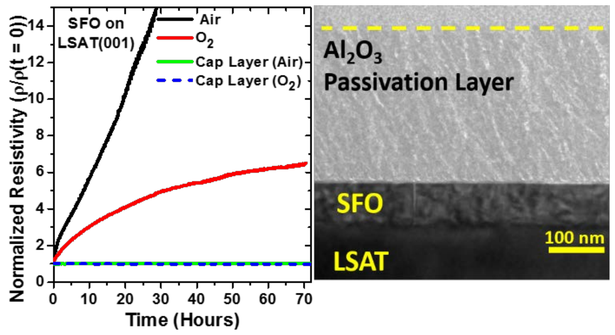
Scientific Achievement: Single-nanotube photoluminescence (PL) imaging, paired with pump-probe measurements, shows different polymer wrapping agents create different nanoscale surface structures that promote or inhibit exciton transport within carbon nanotube (CNT) thin films.

Significance & Impact: Polymer-wrapped CNTs are a source of high quality material for thin film electronics and photovoltaic applications. This work indicates that polymer molecular structure translates to surface structures that impact device performance. The results provide strategies for optimizing transport properties.

Research Details: Here we present the results of a combined pump-probe and photoluminescence imaging study of polyfluorene-wrapped (6,5) and (7,5) SWCNTs that provide additional insight into the role played by polymer structures in defining exciton transport.

- Ultrafast pump-probe measurements show polymer structure impacts exciton transport pathways and dynamics.
- PL imaging of surface structures indicates that the more open surface structure in PFO-wrapped nanotubes promotes transport.

"Oxygen vacancy-driven evolution of structural and electrical properties in SrFeO3−δ thin films and a method of stabilization", published in Applied Physics Letters *(Enriquez et al.)*



Scientific Achievement: We demonstrated the instability of oxygen stoichiometry in SrFeO3-δ (SFO) thin films at room temperature, and successfully developed a method to stabilize the oxygen content in the films.

Significance & Impact: SFO exhibits multifunctionalities important for technological applications. Its properties, however, are very sensitive to oxygen content. We have established a method to control the SFO structure and physical properties through the stabilization of oxygen content.

Research Details: In order to effectively use SFO in technological applications, stability of the oxygen content is required, so an amorphous Al2O3 passivation layer is incorporated and is found to be effective in stabilizing the structure and electrical properties of SFO thin films. This work explores time dependent structure and properties variation in oxide films and provides a way to stabilize thin film materials which are sensitive to oxygen vacancies.

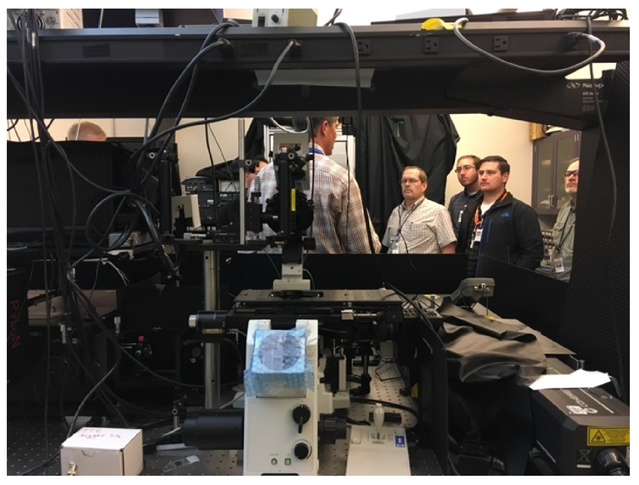
- SFO thin films, spontaneously losing oxygen over time in various ambient conditions at room temperature, are approved by structural and electronic property measurements.
- Ambient humidity and substrate strain are discovered to be as the contributing factors in the evolution of oxygen vacancy concentration.
- An amorphous Al_2O_3 passivation layer is introduced on the surface of SFO and is shown to prevent any observable oxygen loss, stabilizing the structure and electronic transport properties.

Scientific Leadership

- *Nate Mara* (CINT NEM Co-Thrust Leader) hosted the incoming American Welding Society President John R. Bray at the CINT Gateway Facility for an overview of CINT and a tours of Nanomechanics and Soft, Biological and Composite Nanomaterials laboratories on January 25, 2017.
- A CINT Core Facility tour was given for a group of 29 Turkish scientist who are part of Sandia National Laboratories International Biological and Chemical Threat Reduction (SNL/IBCTR) program. The program is part of the US Department of Defense, Cooperative Biological Engagement Program (CBEP) conducted introductory bio-risk management (BRM) training for management and staff from laboratories in Turkey.
- *Stephen Doorn* (CINT NPON Co-Thrust Leader) gave an invited talk at the 2016 Fall MRS meeting in Boston titled, "Defect-Induced Exciton Localization for New Carbon Nanotube Functionality", given in the Symposium on Nanotubes and Related Nanostructures.
- *Amalie Frischknect* (CINT TSNP Scientist) gave an invited talk entitled on 'Simulation of Morphology and Dynamics in Ion-Containing Polymers' on February 2 at the 2017 Materials Research Outreach Program Symposium at the University of California, Santa Barbara. Ionomers, polymers containing a small fraction of covalently bound ionic groups, are of interest as electrolytes in batteries and as membranes in fuel cells. The symposium is designed to stimulate collaborative research between faculty groups at UCSB and industry scientists and engineers.
- *John Watt's* (CINT SBCN scientist) invited paper "Magnetically Recoverable Pd/Fe3O4 Core-Shell Nanowire Clusters with Increased Hydrogenation Activity" was published as part of ChemPlusChem's Early Career Series.

Outreach Activity and News

- CINT hosted a tour of 30 Los Alamos National Laboratory engineers as part of an outreach effort to increase internal awareness of CINT and its capabilities. CINT scientists Stephen Doorn, Jennifer Hollingsworth and Nate Mara hosted the laboratory tours.
- CINT User Program and Outreach Staff Linda Chavez, Jessica Vanderburg and Cathy Jo Beecher visited the Center for Nanophase Materials Science at Oakridge National Laboratory to meet with their staff and tour the CNMS and Spallation Neutron Source (SNS) facilities.



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