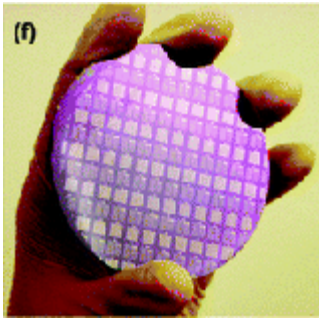


The NNN Newsletter

Carbon Nanotube Thin Film Transistors—Ready for Prime Time?



Recent efforts to synthesize carbon nanotube networks in a transistor integration strategy have shown significant promise as an alternative technology for large area TFT applications. With new knowledge of necessary process control mechanisms and carbon

nanotube network properties, these approaches use solution-based assembly techniques to achieve specific device parameters by design and have the potential to gain a foothold in a high-end consumer products markets.

Single walled carbon nanotubes (SWCNT) have gained significant attention over the past decade due to potentially superior electronic, mechanical, and chemical properties. For nanoelectronic applications, transistors fabricated from individual SWCNTs exhibit very high carrier mobility, yet have limited current carrying ability due to their nanoscale size. Furthermore, practical approaches to fabricate large scale integrated circuits have not yet been realized. In contrast, TFT applications simply require sufficient device characteristics (Ion/Ioff ratio, maximum current, and carrier mobility) in a thin, nominally transparent design configuration and can be fabricated by low-cost, scalable processes. Progress in device synthesis has been limited by the chirality properties of the SWCNT networks, which typically contain a mixture of semiconducting and metallic CNTs. As the SWCNTs are assembled in an overlapping configuration between the source and drain of the transistor, percolation transport through metallic nanotubes limits the device on/off ratio, yet enables high current handling capability. Rigorous purification processes have been used to yield SWCNT networks composed primarily of semiconducting nanotubes.

A handful of studies published within the last year have focused on the process of integrating SWCNT networks into TFTs with very positive outcomes for industrial scale up. The knowledge gained from this nanomanufacturing research has provided sufficient progress suggesting these approaches may be suitable for rigorous process scale-up for specific applications. With key metrics for

Upcoming Events

December 18 - 19, 2009
[2009 International Conference on Semiconductor Technology](#)

December 21 - 23, 2009
[25th Regional Conference on Solid State Science and Technology](#)

December 28 - 30, 2009
[ICMENS 2009](#)

January 3 - 8, 2010
[IEEE International NanoElectronics Conference](#)

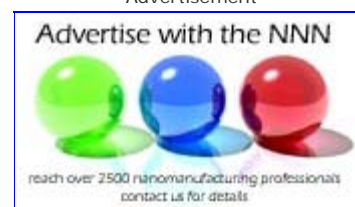
January 17 - 22, 2010
[Gordon Research Conference: Toward the Development of Sustainable and Nanotechnology-Inspired Multi-Functional Composites](#)

January 23 - 28, 2010
[LASE: SPIE Photonics West](#)

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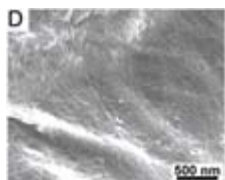
TFT devices being demonstrated, applications realizing an immediate benefit from this manufacturing approach include displays, lighting, and electronic paper. This month we take a closer look at three key papers in this area that have fostered significant interest within the community.

[More...](#)

Regards,
Jeff Morse, Managing Director,
National Nanomanufacturing Network

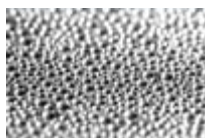
Learn More about the 

Nanomaterial Enabled Conductive Paper: A New Paradigm for Flexible Electronics and Energy Storage



While nanostructured materials combined with emerging nanomanufacturing processes are advancing the next generation of displays, e-paper, renewable energy, and energy storage devices, the predominant technologies have employed scaled processes on flexible substrates facilitated by roll-to-roll platforms. Recently, a group of researchers at Stanford University have taken this concept one step further by demonstrating the core materials and processes for fabrication of such devices on everyday paper. Hu et. al. from Yi Cui's research group in Stanford's Materials Science and Engineering Department reported their investigation of single walled carbon nanotubes (SWCNTs) dispersed in inks to create high conductivity electrodes on regular paper. [More....](#)

Working Group Makes Important Contribution to EPA's Scientific Advisory Panel on Nanosilver



On November 3 – 6, 2009 the US Environmental Protection Agency (EPA) held a Scientific Advisory Panel (SAP) meeting in Arlington, Virginia to discuss the "Evaluation of Hazard and Exposure Associated with Nanosilver and Other Nanometal Oxide Pesticide Products." Over seventy-five people from industry, regulatory, public interest, and academic sectors attended the meeting over three days. The EPA received presentations and comments from the SAP panel members during the course of the meeting, as

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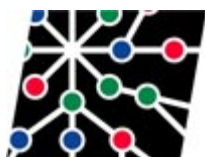
Wetting and Superhydrophobicity
[Langmuir 25 \(24\): 14100-14104](#)

Formation and Size Tuning of Colloidal Microcapsules via Host-Guest Molecular Recognition at the Liquid-Liquid Interface
[Langmuir 25\(24\): 13852-13854](#)

2,5-Dichlorothiophene 1,1-dioxide
[Acta Crystallographica Section E-Structure Reports Online 65: O3258-U2026](#)

well as six presentations during the Public Comment period. One group—The Silver Nanotechnology Working Group (SNWG)—made a detailed presentation supporting a fundamental regulatory consideration previously overlooked by many in attendance: nanosilver has been rationally manufactured, regulated, and used commercially for over a century with no significant adverse environmental, health, and safety effects. [More....](#)

Herr and Caprio Round Out Editorial Team



The National Nanomanufacturing Network is pleased to welcome two additional Contributing Editors who will round out the NNN's Editorial Team for 2010.

Daniel Herr and Vincent Caprio will bring their expertise to bear on Advanced Processes + Tools and Business + Entrepreneurship focus areas for InterNano. [More...](#)

[Read more on](#) **InterNano**

Nitrogen Dioxide Vapor Detection Using Poly-O-Toluidine

[Sensors and Actuators B-Chemical 141\(1\): 454-457](#)

Measuring the Structure of Epitaxially Assembled Block Copolymer Domains with Soft X-Ray Diffraction

[Macromolecules Article ASAP 30 November 2009](#)

Happy Holidays



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Our mailing address is:
The National Nanomanufacturing Network
322 Lederle Graduate Research Center
710 N. Pleasant Street
University of Massachusetts
Amherst, MA 01003

Our email address is:
nnn@nanomanufacturing.org

Our phone number is:
(413) 577-0570

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