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Flow-driven alignment of carbon nanotubes during floating evaporative self assembly ARGANTHAEL BERSON, KATHERINE JINKINS, JASON CHAN, GERALD BRADY, Univ of Wisconsin, Madison, KJERSTIN GRONSKI, Univ of Wisconsin, Platteville, PADMA GOPALAN, Univ of Wisconsin, Madison, HAROLD EVENSEN, Univ of Wisconsin, Platteville, MICHAEL ARNOLD, Univ of Wisconsin, Madison — Individual semi-conducting single-wall carbon nanotubes (s-SWCNTs) exhibit exceptional electronic properties, which makes them promising candidates for the next generation of semi-conductor electronics. In practice, field-effect transistors (FETs) are fabricated from arrays of s-SWCNTs deposited onto a substrate. In order to achieve high electronic performance, the s-SWCNTs in these arrays must be densely packed and well aligned. Floating Evaporative Self Assembly (FESA) is a new deposition technique developed at the UW-Madison that can achieve such high-quality s-SWCNT alignment. For example, it was used to fabricate the first s-SWCNT-based FETs to outperform gallium arsenide and silicon FETs. In FESA, a droplet of ink containing the s-SWCNTs is deposited onto a pool of water. The ink spreads on the water surface towards a substrate that is vertically pulled out of the water. A band of aligned s-SWCNTs is deposited with each drop of ink. High-speed imaging is combined with cross-polarized microscopy to elucidate the mechanisms behind the exceptional alignment of s-SWCNTs. Two key mechanisms are 1) the collection of s-SWCNTs at the ink-water interface and 2) the depinning of the air-ink-substrate contact line. Avenues for scaling up FESA will be presented.

Arganthael Berson
Univ of Wisconsin, Madison

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