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Wafer-scale Meniscus Alignment of Carbon Nanotubes JOSHUA WOOD, VINEET NAZARETH, JOSEPH LYDING, University of Illinois at Urbana-Champaign — Making single-walled carbon nanotubes (SWNTs) a possible next-generation transistor nanotechnology requires control of their chirality, length, placement, and alignment. We develop a method for controlled placement and alignment of SWNTs using mechanical meniscus action. In this technique, we suspend surfactant-coated SWNTs in aqueous solution and place the solution between two surfaces of differing hydrophobicity, forming a meniscus. We drag this meniscus across the bottom substrate, causing SWNT alignment in the meniscus drag direction by torque. Alignment critically depends on the meniscus velocity and the substrate's contact angle, parameters that we determine from Monte Carlo simulation. On the H-passivated Si(111) surface, our SWNTs align with at an angle of $4.35 \pm 37.94^\circ$ relative to the meniscus direction, indicating good alignment. We place SWNTs in densities of up to $\sim$30 SWNTs/μm^2, with the density exponentially dependent on the number of meniscus passes. In comparison to aligning SWNTs during growth or by dielectrophoresis, our technique aligns SWNTs on the wafer-scale while controlling SWNT density and using chirally pure SWNTs.

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