



Materials Science and Engineering

Raman Spectroscopy for Characterization of Aligned Carbon Nanotube Films

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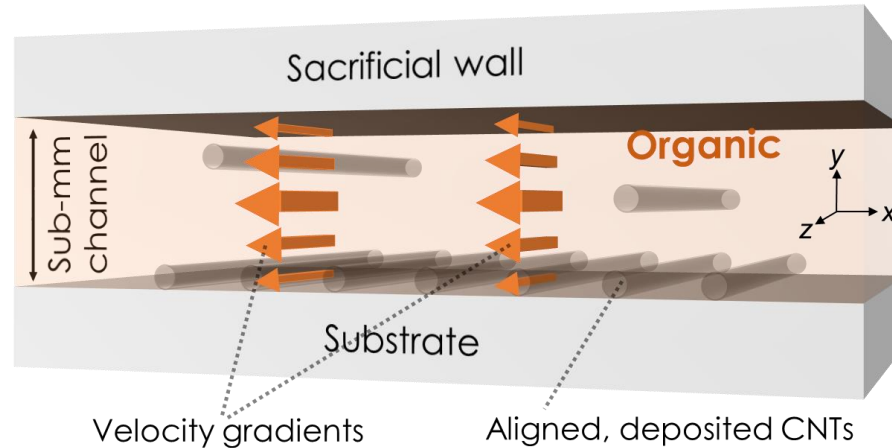
NSF SNM-IS (1727523)
NSF GRFP (DGE-1256259)

Carbon Nanotube (CNT): Tube of Carbon Atoms in a Hexagonal Lattice



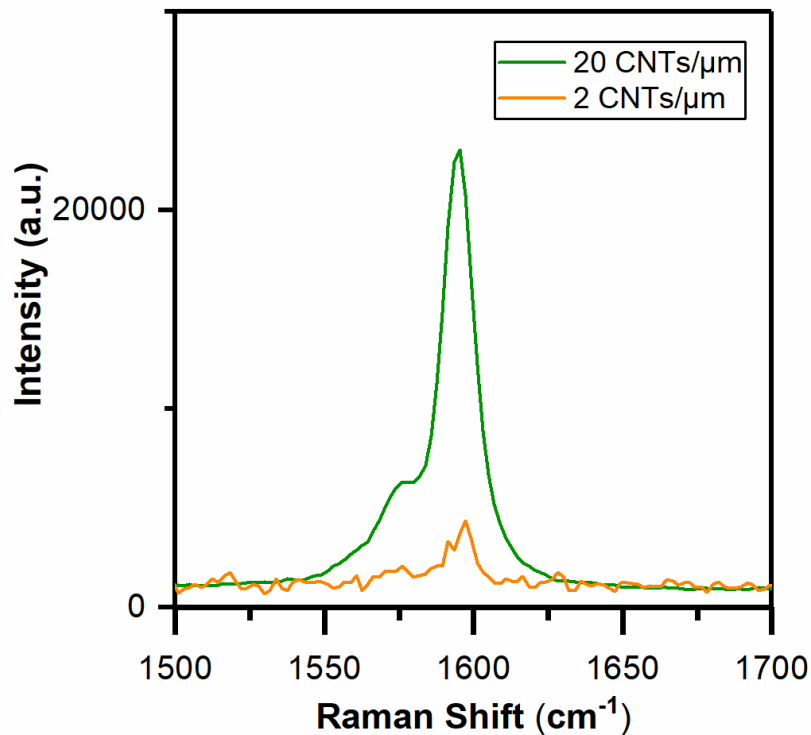
- Flexible Electronics
- More efficient/ “cooler” electronics

Confined, Shear-Based Alignment



- Shear aligns carbon nanotubes from solution
- Confocal Raman spectroscopy allows for measurement of packing density and degree of alignment

Measuring Nanotube Density

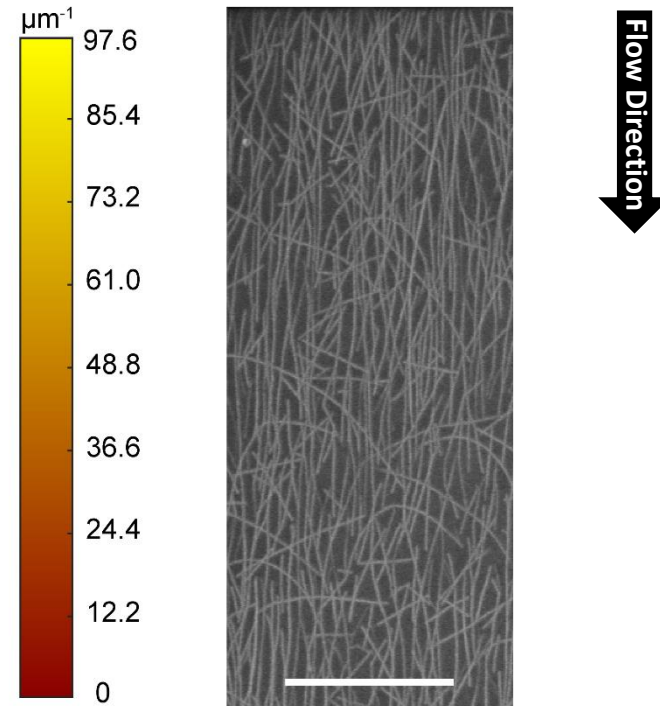
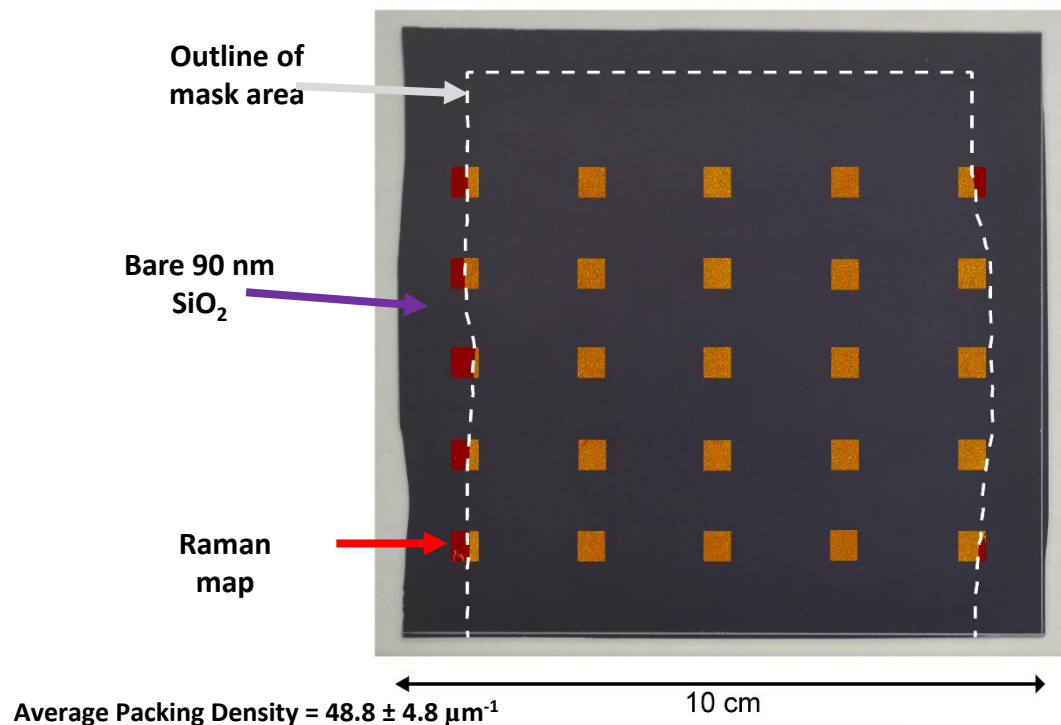


Intensity of carbon nanotube G-band directly related to the amount of carbon nanotubes in the sample!

- Measure packing densities

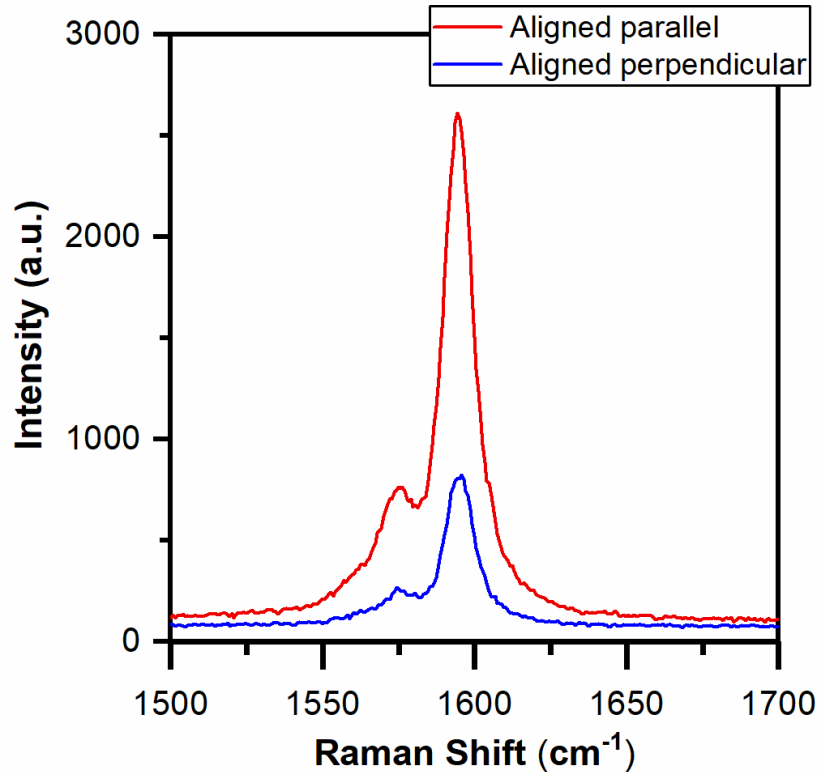
Measuring Nanotube Density

Can use Confocal Raman spectroscopy mapping to measure packing density uniformity across 10 x 10 cm² substrate!



Jinkins, K.R., et al., *Adv. Electron. Mater.* **2019**, 5, 1800593

Measuring Alignment in Nanotube Films



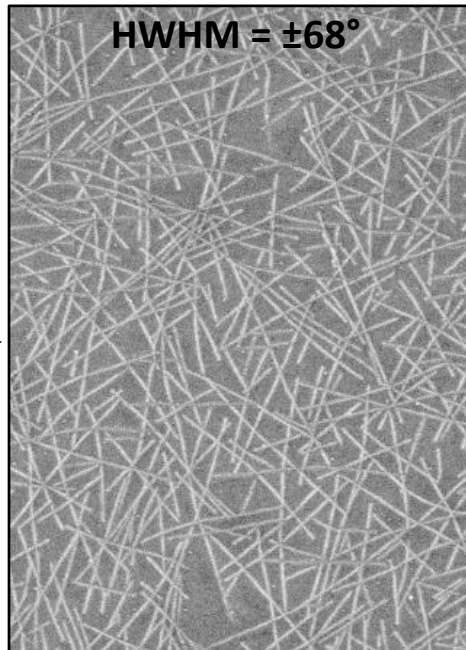
Intensity of carbon nanotube G-band sensitive to laser polarization!

- Measure degree of alignment in films

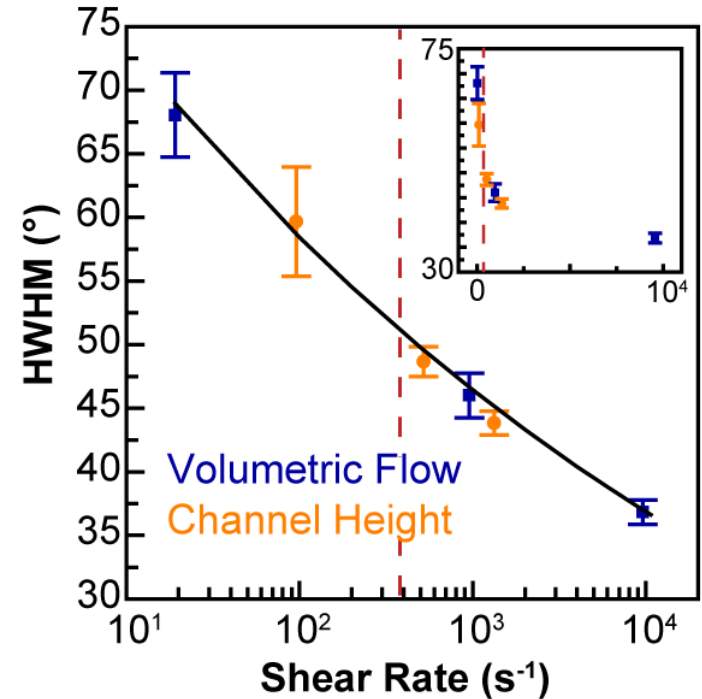
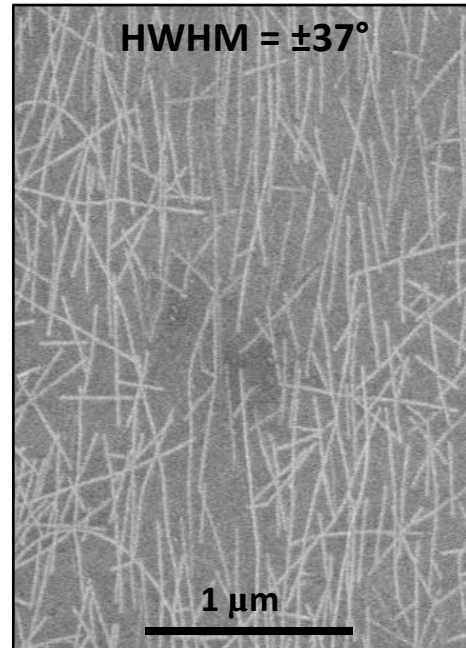
Measuring Alignment in Nanotube Films

Degree of alignment (via Raman spectroscopy) as a function of shear rate

Low Shear



High Shear



Jenkins, K.R., et al., *Adv. Electron. Mater.* **2019**, 5, 1800593