NanoIntegris

Instructions for Making Surfactant-Free Thin-Films with NanoIntegris CNT Solutions *

USE THESE INSTRUCTIONS IF:

You want to deposit a non-aligned CNT network—ranging in thickness from approximately 5-100 nm—on one of a variety of substrates, such as glass, plastic, or silicon dioxide.

Required Equipment:

- Bath sonicator
- Vacuum **(or pressure)** filtration system
- Mixed cellulose ester **(MCE)** filters
  - Recommended pore size: **25-50 nm**
  - Recommended filter diameter: **25 mm**

Required Materials/Chemicals:

- CNT's
- Water
- w/v Sodium Dodecyl Sulfate (SDS)
- 2-propanol
- Ethanol
- Acetone
- Methanol
- Compressed air or Nitrogen

Additional Notes

- Finished thin-films should contain less than ~0.5% surfactant by mass.
- Approximately 30 µg of NanoIntegris CNTs is required to uniformly coat an area of ~200 mm2 at ~80% visible transmittance.

* **For more information, see:**

Wu, Z. C. et al. Transparent, conductive carbon nanotube films. *Science* 305, 1273–1276 (2004)

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To Prepare a Thin-Film of NanoIntegris CNTs on an MCE Filter

1. Dilute NanoIntegris CNT solution to ~1-10 µg/mL using a combination of water and 1% w/v sodium dodecyl sulfate (SDS).
2. Using a vacuum or pressure filtration apparatus, pass the diluted NanoIntegris CNT solution through an MCE filter. A thin-film of nanotubes will accumulate on the filter's surface. (Surfactant and water will pass through the filter; nanotubes will not.)
3. Once the desired volume of CNT solution has been filtered, allow the resulting CNT film to set for approximately 15 minutes.
4. Gently rinse the film with ~1 mL of 2-propanol.
5. Gently rinse the film with ~30 mL of water.
6. Allow the film to set again for approximately 15 minutes.

To Transfer the Thin-Film from the MCE Filer to Another Substrate

1. Briefly dip the nanotube-coated MCE filter in ethanol.
2. Using gentle pressure, press the filter film-side-down against the desired substrate.
3. Immediately suspend the substrate/filter horizontally over a bath of boiling acetone (suspend filter-side up, approximately 2" above the liquid.) The acetone vapors will gradually dissolve the MCE filter.
4. Let sit until the MCE filter is no longer visible (usually about 1 hour).
5. Place the substrate in a stirred bath of liquid acetone for 15 minutes to remove the remaining MCE residue.
6. Immediately transfer the substrate to a stirred bath of methanol for an additional 15 minutes.
7. Gently dry the CNT film with compressed air or nitrogen.
8. (Optional). To further improve (i.e., reduce) the sheet resistance of the CNT film, bake for 1-2 hours at 250°C in air.