

Spin-Coating Processing of PEDOT:PSS

Standard Operating Procedure

Faculty Supervisor: Prof. Robert White, Mechanical Engineering (x72210)

Safety Office: Peter Nowak x73246 (Just dial this directly on any campus phone.)
(617)627-3246 (From off-campus or from a cell phone)

Tufts Emergency Medical Services are at x66911.

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Goal:

Deposit and bake a PEDOT:PSS thin film as semiconductor. Ref. *Appl. Phys. Lett.* **99** 163304 (2001)

Warnings:

The chemicals you are working with here are not acutely hazardous. However, all processing (including hotplate bakes) must be done in the fume hood, as the solvent fumes released during processing have long-term health effects. The main things is to not breathe any fumes, not to get any of the mixture on your skin.

1.0 Material Requirements:

- 1.1 Equipment and tools: Spin processor, hotplates, tweezers, vials
- 1.2 Chemicals: Poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT:PSS), ethylene glycol (EG), dodecyl benzene sulfonic acid (DBSA), 3-glycidoxypropyltrimethoxysilane, acetone, isopropanol. Note that these chemicals will be mixed in a separate area and brought into the microfab for processing.
 - 1.2.1 Hazards associated with chemicals:
 - 1.2.1.1 PEDOT:PSS is non-hazardous material. It emits toxic fumes under incineration.
 - 1.2.1.2 EG may cause damage to organs through prolonged or repeated exposure.
 - 1.2.1.3 DBSA causes severe skin burns and eye damage. It is a corrosive material. Keep containers tightly closed in a dry, cool and well-ventilated place.
 - 1.2.1.4 3-glycidoxypropyltrimethoxysilane causes serious eye damage. It is suspected of causing genetic defects. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Do not ingest. Keep in a dry, cool and well-ventilated place. Keep container tightly closed.
 - 1.2.1.5 Acetone is a volatile, flammable solvent. Avoid heat sources. Do not breathe fumes. Conduct processing in the fume hood.
 - 1.2.1.6 Isopropanol is a volatile, flammable solvent. Avoid heat sources. Do not breathe fumes. Conduct processing in the fume hood.
- 1.3 Engineering Controls: Conduct procedures in the fume hood. Dispose of chemicals as described at the end of this document.
- 1.4 Personal Protective Equipment: Nitrile gloves and eye protection required for all procedures. When working in the fume hood, also wear trionic gloves, apron, and chemical goggles.

2.0 Procedure:

Complete all processes in the fume hood.

- 2.1 Prepare PEDOT:PSS solutions in a disposable glass vial before entering clean room. The glass vial should be labeled with the names and ratios of the chemicals, the date mixed, and the mixer's name.
 - 2.1.1 To improve the conductivity of the resulting PEDOT:PSS film, 5ml of ethylene glycol (EG) and 50 μ l of dodecyl benzene sulfonic acid (DBSA) were added in 20ml of PEDOT:PSS dispersion.
 - 2.1.2 0.25g of 3-glycidoxypropyltrimethoxysilane was added (the cross-linker).

- 2.2 Spin on your solution. (See Laurell Spinner SOP for instructions on using the spinner.)
 - 2.2.1 Substrate should be clean prior to starting processing. A Piranha clean (see Piranha clean SOP) is suggested.
 - 2.2.2 Start at 200 rpm for 3 s and go to 650 rpm for 3 s. Then spin at 650 rpm for 60 s, results in approximately a 80 nm thick film. (The dirty spinner should be used.)
- 2.3 Soft bake (should be conducted with the hotplates in the chemical hood) at 140°C for 1hr.
- 2.4 Cleanup:
 - 2.4.1 Turn off the hotplates.
 - 2.4.2 Clean off any residue from any tools or surfaces using acetone, isopropanol, and cleanroom wipes. Dispose of in the solvent/photoresist trash.
 - 2.4.3 Remove the hotplates from the hood.

3.0 Storage:

- 3.1 All materials should be stored in a approved container when not in use. The residual solution will be stored outside the microfab.

4.0 Waste Disposal:

- 4.1 Solid waste should go in the solvent/photoresist trash.
- 4.2 Liquid waste should go in the solvent/photoresist liquid waste bottle.
- 4.3 A vial should go in the sharps waste.

5.0 Accident Procedures:

- 5.1 Contact: Read SDS prior to working with any chemical to familiarize yourself with the symptoms of exposure and recommendations for treatment.
 - 5.1.1 Inhalation: If you breathe these fumes, you may feel dizzy. If this occurs, turn off the hotplates and leave everything in the hood. Leave the room and get some fresh air. If symptoms persist, contact Tufts health services and inform the lab directory and Tufts health and safety office. **Call Tufts Emergency Medical Service at x66911.**
 - 5.1.2 Skin contact: For minor contact, exit the lab and rinse the affected area with water. For major contact get in the safety shower and remove the affected clothing. Have someone call emergency health services. **Call Tufts Emergency Medical Service at x66911.**
 - 5.1.3 Eye contact: Immediately flush with water for at least 15 minutes at eye wash station while lifting upper and lower eyelids occasionally. Get immediate medical attention. **Call Tufts Emergency Medical Service at x66911.**
- 5.2 Spill:
 - 5.2.1 If a small, contained spill occurs, such as inside the hood, wipe it up with chemical wipes and dispose of in the solvent trash container.
 - 5.2.2 If a large spill occurs that you are not comfortable cleaning up, such as breaking a bottle on the floor, evacuate the lab and contact Tufts emergency services (x66911).
- 5.3 Fire: Do not put the mixed solution on or near the hotplates when they are turned on. If a fire starts, remove any solvents from near the fire if it is safe to do so, and exit the lab. Do not try to fight the fire. **Immediately contact Tufts emergency services once you are outside the lab at Tufts Emergency Services at x66911.**

If at any time you feel a situation is dangerous, do not hesitate to call the safety office (x73246, Peter Nowak) or the faculty supervisor (x72210, Robert White). Please inform of the faculty supervisor and/or the health and safety office of any accident or health concern.

Report all accidents (injuries, major spills, fires) to the safety office at x73246 (Peter Nowak) and the faculty supervisor at x72210 (Robert White). For emergencies, call Tufts Emergency Services at x66911.