

## Organic Photovoltaics (OPVs) – Green River Fabrication Process

(Goggles and Gloves MUST be worn at all times)

Process	Steps
Cutting substrates	Use a scorer and a grid printed on paper to cut the ITO glass
Cleaning	<p><u>Student</u></p> <ol style="list-style-type: none"> <li>1) Place substrates on substrate holder. Rinse with micro-90 soap solution. Place in beaker containing micro-90 soap solution and sonicate for 10 minutes.</li> <li>2) Then rinse with de-ionized water. Place in beaker containing de-ionized water and sonicate for 10 minutes.</li> <li>3) Rinse with Acetone – <u>this has to be done over the funnel leading into the “waste bottle”</u>. Place in beaker containing Acetone and sonicate for 15 minutes.</li> <li>4) Rinse with Isopropyl Alcohol – <u>again this has to be done over the funnel leading into the “waste bottle”</u>. Place in beaker containing Isopropyl alcohol and sonicate for 15 minutes.</li> <li>5) Dry the samples with air in the fume hood.</li> </ol> <p><u>Instructor</u> Measure out PEDOT-PSS (100 <math>\mu</math>L per anode). Use a syringe to remove PEDOT from bottle and transfer to vial through a 0.45 nylon filter. Sonicate briefly (30 seconds).</p> <p><u>Student</u> Remove the dirty Al foil in the spin coater. Cut a new Al foil to size and surround the chuck with it. Remove the double-sticky tape from the chuck and put two fresh ones on in perpendicular directions. Make sure the tapes have “handles” so you can remove them easily. Before you start, have the following materials and equipment at hand:</p> <ul style="list-style-type: none"> <li>• 100 <math>\mu</math>L pipette with 6 – 8 micropipette tips in a beaker.</li> <li>• Vial holder with vial containing the filtered, sonicated PEDOT.</li> <li>• Timer</li> <li>• Waste bucket to get rid of used tips.</li> </ul> <p>Now you are ready to start spin coating the PEDOT layer!</p> <p>Follow the following steps carefully after the instructor demonstrates the process to you:</p> <p>Using a pair of forceps (preferred) or your gloved hand, pick up a substrate and place it ITO side up on the sticky tape on the chuck.</p> <p>Micropipette 100 <math>\mu</math>L of PEDOT on substrate and spin coat at 4000rpm for 30</p>

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Spin Coating	<p>seconds. For this, I simply placed the double sticky tape on the chuck, held the substrate between my fingers, only touching it at the edges and placed it on the tape. Setting the speed took a few seconds. I then set the timer on and spun the sample at 4000rpm for 30 seconds. I had to use my gloved fingers to remove the sample also since grabbing the sample with forceps did not work.</p> <p>Measure out active layer components (PCBM and P3HT). Used the regular ratio of 0.6:1.</p> <p>Using syringe (with needle), add 1.0mL of dichlorobenzene using a PTFE filter. Leave overnight on stirring hot plate at room temperature.</p> <p>Next morning, filter the active layer through a PTFE filter.</p> <p>Spin coat 100 <math>\mu</math>L of the filtered active layer per sample on top of the PEDOT layer. Anneal coated anodes in Al covered petri dish at 140<sup>o</sup>C for 10 minutes. Cool.</p>
Putting together the device	<p>Materials needed:</p> <ol style="list-style-type: none"> <li>a) Ga-In eutectic</li> <li>b) Small weigh boats</li> <li>c) 3 minute epoxy</li> <li>d) Syringe needle</li> <li>e) Cue tips</li> <li>f) Cleaned cathodes</li> <li>g) Coated and cooled anodes</li> <li>h) Clean sheet of paper.</li> </ol> <p>Using the base of the cue tip (the non-cotton side), take a VERY small amount of eutectic. Tap this base on the first quadrant of the cathode (ITO side up). As you tap the eutectic will fall off on to the cathode. Spread the eutectic into a circle (it might help to use a mask). You want the eutectic electrode to be as close to a circle as possible so you can calculate its area later.</p> <p>Mix the two components of the epoxy together in a small weigh boat ( a pea sized amount of each component is enough). Use the syringe needle (or a spatula) to mix thoroughly. Take a tiny amount of epoxy and form an ring around the eutectic circle taking care to leave space between the eutectic and the epoxy. The epoxy ring should be continuous (no breaks) and there should be enough epoxy such that the eutectic does not spill through when the two substrates are put together.</p> <p>Working quickly but carefully, take the spin coated anode and invert it on top of the cathode i.e. the ITO layer of the anode must be placed on the ITO layer of the cathode. Hold the anode down by pressing the base of a clean cue tip on the anode just above the eutectic. Wait for about 30 seconds before lifting the cue tip. Leave the device alone for about half an hour to make sure the epoxy forms a good seal. The device is now ready to be tested!</p>