Solar Panel Assembly Procedure

# REQUIRED TOOLS, MATERIALS, COMPONENTS:

* Tweezers
* Scissors
* Exacto-knife or scalpel
* Petri Dish
* Isopropyl Alcohol
* Delicate wipes
* Stirring sticks
* Solar panels (We bought from Spectrolab
* Solar panel adhesive (Nusil CV4-1161-5)
* Silver Epoxy (MG Chemicals, 4-hour working time, extreme conductivity)
* Tin or Silver strips (Kastar)
* No-clean solder (Chipquick SMD4300AX10T5)
* Solder spreader
* Soldering iron or hot-air pencil
* Clean-room gear (smock, hair net, foot covers)

**Facilities:**

* Clean Room
* Thermal chamber

# CLEANING / PRE-ENTRY

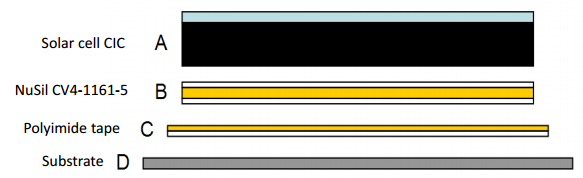
* Clean everything that’s going to be taken into the cleanroom as much as possible.
* This includes:
* Tools (tweezers, plyers, tape, hot-air pencil/gun)
* Materials (Silver epoxy, solar panel adhesive, PCBs)
* Laptop
* Packages, remove items from cardboard packaging and clean what you plan on taking in.
* **Don’t bring in pencil or paper**
* How to clean:
* Wipe as much down with alcohol
* Give PCBs an alcohol bath / wipe
* Give laptop an alcohol wipe
* Make a checklist of materials / tools / components that you plan on bringing in with you to make sure you don’t forget anything outside the cleanroom and vice-versa.

# PRACTICE APPLICATION

* The first time you adhere solar panels should not be the only time you do so.
* Make sure to have extra PCBs and solar panels that can be used for practice.
* NOTE: We needed to apply 22 and hence had 4 extra (at Doug Sinclair’s advice) and we also had one to practice with which we were given by the CSDC.

# PROCEDURE

Adopted from: <http://mstl.atl.calpoly.edu/~bklofas/Presentations/SummerWorkshop2009/Sat_1425_Solar%20Cell%20Installation%20Using%20Double%20Sided%20Polysiloxane%20PSA%20Film%20-%20Petras%20Karuza.pdf> (alternate method)



* We aren’t using the polyimide tape because we are applying the solar cells to a PCB surface instead of metal.

## Prepare substrate so that surface is flat.

* If you’re applying your solar panels to a PCB, you can skip this step.

## Remove solar cell backside feature

* First inspect solar panel
* Practice handling solar cell, they are very brittle
* If the diode on the back is too thick, you may need to remove it.

## Epoxy Tin Strips to the Solar Cells

* Mix 1-1 of part A and part B of the silver epoxy
* Remember that the mixture only has a 4 hour working time Time created = 6:06pm
* Apply the silver epoxy mixture to the tin strip and apply to the solar panel near the diode tab.
* **You really need very little of this, if it looks like you have barely enough on to coat the surface, that’s exactly how much you want.** **We postulate that too much epoxy prevents the surfaces from bonding as our first experiment with the epoxy failed (electrical connection was still good regardless)**
* Make sure to flatten out the tin strip to avoid it being raised by too much epoxy underneath.
* We then cured the silver epoxy in a thermal chamber at 80C for 1 hour.

## Cut and Apply PSA film slightly less than the size of the solar cell

* We made a stencil using a credit card (solder spreader) and cut all the pieces identically.
* By “Slightly less than” we interpreted this as having 2mm all around the PSA film, or being roughly 95% the dimensions of the actual solar cell.
* Remember to cut out sections for the raised features on the bottom of your solar cell.
* If you’re familiar with the method of rolling a screen protector onto the screen for electronic device such as a phone, our method for applying the adhesive to the back of the solar cells was very much the same here. The goal is to have zero bubbles. (We messed up our first one)

## Apply Dots of Solder Paste to Solar Panel PCB

* You should have contacts open to allow you to solder on your solar panels.
* On each of these contacts you’ll need a small dot of solder paste, amount here is judged based on previous experience soldering. (Try practising on one solar cell)

## Peel Off Adhesive cover and stick

* Our technique for placing the solar cells to the PCBs was simply to hold the corners firmly with two fingers and let the solar cell drop into place.

## Solder leads of the solar cells

* At this point the solar cells aren’t going anywhere thanks to the adhesive.
* To make sure that the cells are connected electrically, you’re going to need to flow that solder paste.
* We used a hot air pencil set to 350C.
* Note that this will take longer than usual if attempting to flow a pad which is connected to a large Vcc / GND plane underneath.
* Be sure to leave the heat applied slightly longer than what seems necessary to insure that the paste has truly reflowed.

# Inspection

* If you have access to an x-ray machine, or infrared imaging device, it is possible to inspect the solar cells for bubbles in the adhesive as well as verify solder joints.
* Other methods of inspection involve measuring I-V characteristics while in varying amounts of light / varying amounts of load and comparing this to the theoretical amount.