

## How can solar cells be connected to make a solar panel for a specific purpose?

Silicon solar cells are the most widely used photovoltaic material. A single cell is made out of silicon to convert sunlight directly into electricity. A single cell produces about 0.6 V and a current depending on the area. Cells can be connected in series or in parallel.

### Build a Solar Array:

## Soldering (~15min)

#### 1. Position the Cells:

Lay the unmounted cell flat in series on soldering jigs.

- Match the “+” and “-” terminals so that the positive terminal of one cell connects to the negative of the next.

#### 2. Add Soldering Paste:

Apply a small dot of soldering paste to the six “legs” on each interconnect.

#### 3. Practice with Soldering Iron:

Before working on the cells, practice on a piece of paper.

- Hold the iron like the picture to ensure max contact with the soldering tips.

#### 4. Solder the Cells Together:

Solder each cell, then use copper strips to connect the rows in series. Check that all connections are secure from the side view.

#### 5. Secure with Tape:

Cover the copper strips with electrical tape to prevent shorting. Then, fold the tape inward. Place white stickers between the cells for easy handling.

#### 6. Test the Cells:

Use an EL camera for pre-lamination testing.

- **6.1:** White cells pass.
- **6.2:** Black cells fail.

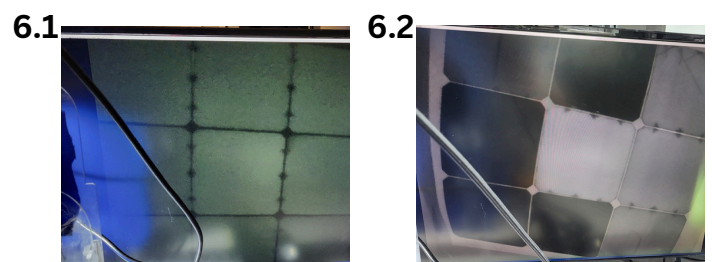
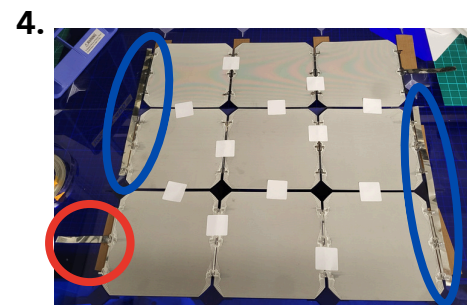
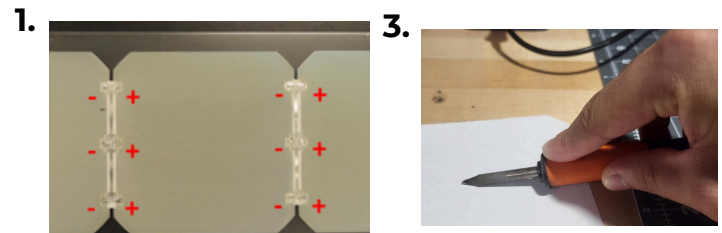
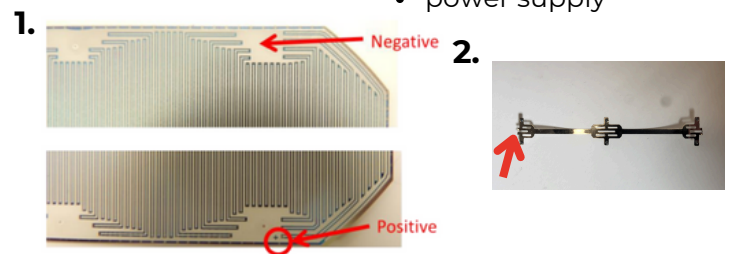
Conduct IV-curve tracing, compare with data sheet, and take notes.

#### 7. Troubleshoot Failed Cells:

If a cell fails, check the connections and polarity. If everything looks fine, run a brief high-current test.

## Materials Needed

- solar cells
- interconnects
- jigs
- soldering paste
- soldering tape
- soldering station
- multimeter
- vinyl gloves
- IPA
- EL Camera
- copper strips
- white electrical tape
- white stickers
- clean wipes
- power supply



## Build a Solar Array: Pre-Shrinking (~25min)

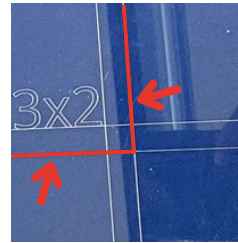
### 1. Prep the machine:

If you used the machine before, remove the vacuum tape and clean the surface with IPA.

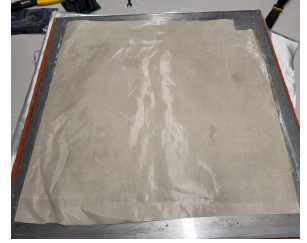
### 2. Layer the sheets:

- **2.1** Cut the frontsheet/backsheet to the appropriate sizes, ensuring you leave a 1 cm margin as labeled in the jig to account for shrinking.
- **2.2** Place a Teflon sheet on the surface.
- **2.3** Add the backsheet/frontsheet, then cover it with another Teflon sheet. Make sure the entire sheet is fully covered by the Teflon sheets.

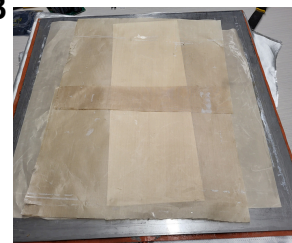
2.1



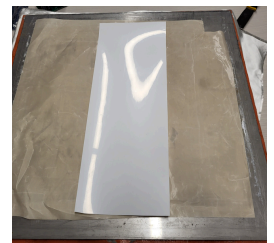
2.2



2.3



2.3



### 3. Prevent warping:

Place a wood plate on top and clamp the corners to the lamination machine.

### 4. Heat:

Turn on the heating plate and set it to 145°C. Let it sit for 10 minutes.

### 5. Unclamp & cool:

After 10 minutes, unclamp the machine and remove the backsheet/frontsheet. Lay them flat to cool.

### 6. Repeat:

Repeat steps 2 and 3 if you are pre-shrinking multiple sheets. Do not turn off the heat.

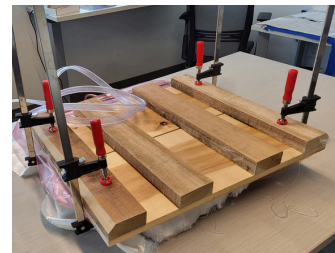
### 7. Finish:

Once all sheets are done, cut off the excess with the jig. The inner line of the jig represents the final dimensions. Then turn off the machine and wait for it to cool down.

## Materials Needed

- Lamination Machine
- Front sheet
- back sheet
- Teflon sheet
- IPA
- Cutting Jig

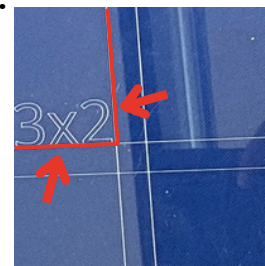
3.



4.



7.



## Build a Solar Array: Laminating (25min)

1. Once the array has passed the testing and both the front and back sheets have been pre-shrunk, follow this to assemble the layers:

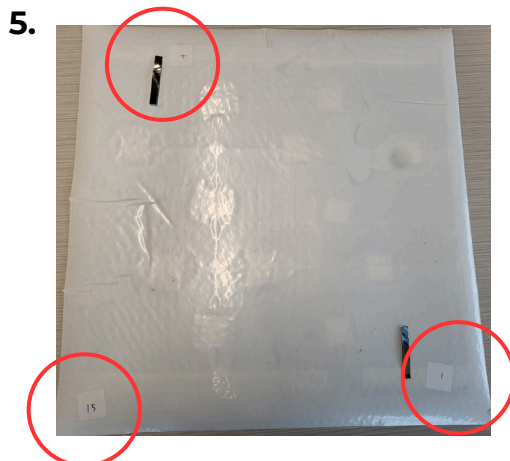
- Front sheet (Mat side to heating plate)
- EVA (no direction)
- Cells (Face gray side up)
- EVA (no direction)
- Back sheet (Face yellow side up)

2. Place vacuum tape along all the sides of the array. Ensure you leave a small gap between the tape and the edges of the solar array.

3. Place the vacuum bag over the machine. Slowly peel off the white backing from the vacuum tape. Ensure the vacuum bag is smooth with minimal creases. Place a wooden board on top and clamp it to prevent warping.

4. Once the array has cooled, remove them from the machine and perform the post-lamination test. This is the same test as described in **Step 6 in Soldering**.

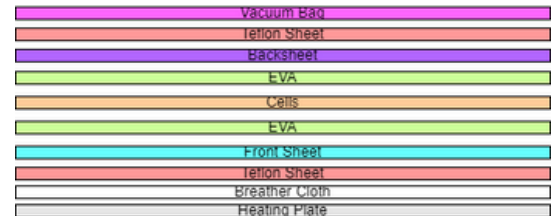
5. Label the arrays clearly (ID & polarity) and store them in a clean, safe space.



## Materials Needed

- Lamination Machine
- Front sheet
- back sheet
- EVA
- Teflon sheet
- Breather cloth

1.

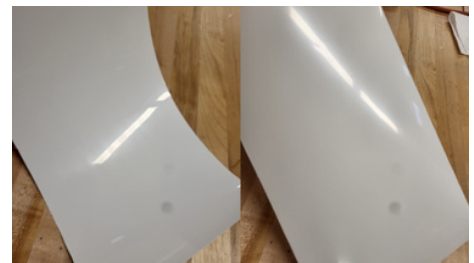


1.a



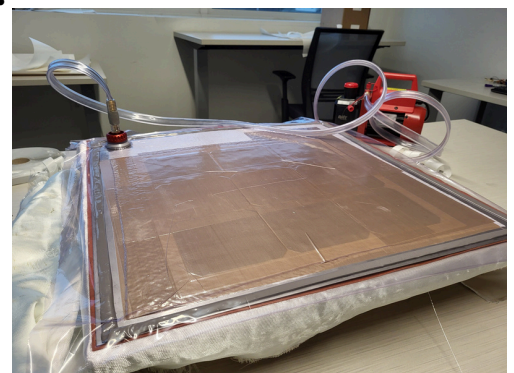
Mat Clear

1.e



White Yellow

2.





# Materials List

## Assembly Materials



Electrical tape



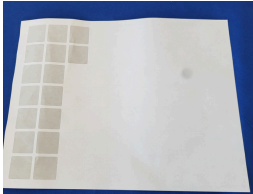
EVA



Fiber Glass



Breather cloth



White stickers



Back sheet



Front sheet



Teflon sheet

## Solar Cell Materials



Solar cells

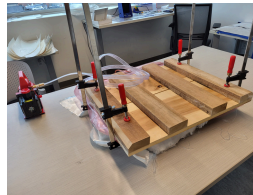


Copper strips



Interconnects

## Lamination Equipment



Lamination machine

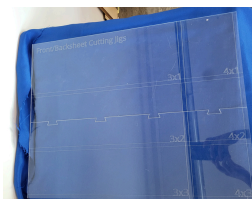


Vacuum pump

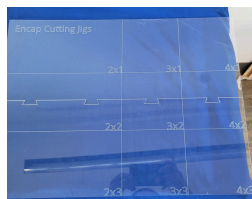
## Soldering Tools



IPA



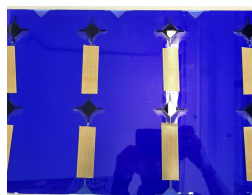
Cutting jigs



Cutting jigs



Soldering station



Soldering jigs



Soldering paste

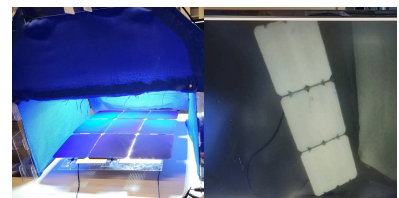


Vinyl gloves



Clean wipes

## Testing Tools



EL Camera



Power supply



Multimeter