Encapsulation method for small Solar Cells, using epoxy and Masonite

To start, select the cells you will be using. If using broken cells, choose a set that are close as possible in length. Try to avoid cells with wax. If necessary, remove small bits of wax carefully with a razor blade or otherwise with care.

Arrange the cells 1/8” apart and cut a piece of 1/4” Masonite 1/2” wider and 2” longer than the layout. Sand the edges (of the Masonite) well and round the corners a bit, sand both faces - make it nice and your finished product will benefit. Apply one coat of water-based acrylic or polyurethane varnish, such as MinWax or Varathane Diamond, on all edges and back face and allow to dry completely.

For each cell, cut on piece of tabbing a bit less than twice the width of the cell. If you’re using un-tinned tabbing, tin it first (coat with thin layer of solder). At all times, keep your tabbing as flat as possible and don’t bother with twisted tabbing.

Use a liquid flux pen on the cell and solder the tabbing carefully to the cell as shown.

For small cells, a 40 watt or 60 watt iron Is generally recommended. Work on a non-heat-conductive surface such as heavy paper, masonite or the back of a tablet of paper; something smooth but not overly soft. For larger cells you may find a 100W gun preferable. Electrical grade rosin core solder works fine. Experiment and practice on junk pieces until you have a good feel for soldering the cells. A fresh, flat tip the width of the tabbing is essential. Without any pressure, find a steady rate that melts the solder just ahead of the iron, and don't pause long enough to overheat the cell, which can cause fracturing. If you’re uncertain of your work, test the cells in the sun to make sure they’re all putting out similar amperage and voltage.
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Arrange the cells face down with the tabbing from the front laying over the back of the next cell. For a set of six cells as shown, make two three-cell strings. Cut and solder a length of tabbing across each end to create a six-cell series string. Be sure all connections are from the front of one cell to the back of the next.

You will find that some vinyl electrical tape placed delicately across the backs of the arrangement will greatly ease handling of the delicate array. In some arrangements, the tape can allow a run of tabbing under the cells, to the connector, without shorting to the backs of the cells.

Don’t flip it back and forth needlessly – minimize handling. You should be able to do all the front tabbing, turn them all over and do all the back connections, and carefully turn it over only once as an assembly. This is a good point at which to test the assembly to make sure it’s working. Test it with a meter in full sun. Voltage should be in the neighborhood of .5 times the number of cells. Current will vary with the size and quality of the cells. The broken cells shown in these pictures produced in the neighborhood of 1.5 amperes.

Cut one of the longer end tabs in the middle for installation of the connector. The back of the cell is positive and the front is negative. Make sure the piece on the left is coming off the front so that the black terminal of the connector is Negative and the red Positive (from the back of the cell on the right).

Bend the two wiring contacts of the connector back at a 90 degree angle so that the connector can sit flush on the Masonite. Bend the two tabbing leads at the correct spacing for the connector and loop them through the connector contacts; solder each.
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Run masking tape around the perimeter of the Masonite as shown. Go around the circumference twice, and rub it firmly onto the edge. Fold the tape down onto the bottom of the board, leaving a nice dam on the top side to contain the epoxy.

Read and follow the epoxy manufacturer’s safety precautions. Good ventilation, a vapor mask and gloves are advised. Mix the epoxy thoroughly and pour half onto the middle of the board. For the six-cell board shown, measuring approximately 8 ¾” square, a total of 100 cc’s of epoxy was used. Spread the epoxy over the board and into all the corners. A small disposable brush from the hardware store works well if you cut the bristles down to about ½” long. If the weather is cool, the epoxy will not be particularly fluid. Spread it around to that the board is covered, and leave the bulk of it distributed in the area where the cells will lie. Slide the cell assembly carefully off your working surface onto the epoxy.

VERY gently use your fingertips to work the cells down into the epoxy. Make sure to center the assembly on the board as you do this. When you feel like everything is down as close as it will go to the Masonite without breakage, distribute the remaining 50% of the epoxy and brush it out evenly over the whole panel. If working in cool temperatures, a hair dryer can be used to warm the resin and flow it out more evenly. In any case the epoxy will tend to flow out slowly on its own. Avoid applying heat to the epoxy once it has started to thicken as it cures.
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When the epoxy has set, remove the tape and trim the meniscus that formed against the tape. If you catch it at the right time, the epoxy will still be like a soft plastic and it can be trimmed with a sharp knife or razor blade. Otherwise it can be filed down. Test it again to make sure nothing went wrong, and you should now have a handsomely finished solar panel to work with.

Materials:
- Solar cells – www.siliconsolar.com or wherever you can find them!
- Electronics grade solder - Radio Shack, Fry’s, any electronics shop
- Push-release speaker terminal - Radio Shack part #274-632
- Masonite – ¼” - any hardware or lumber store
- Water-based varnish (MinWax or Varathane “Diamond”) - hardware store