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TUTORIAL

Solar Panel Assembly from Solar Cells to Charge Deep Cycle

Batteries

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Abstract: solar panels serves as a renewable and free energy source and are used world wide. It can deliver free electrical power by converting the solar energy. Solar panels are also used in places where people have no access to a power grid. Sometimes buying a commercial solar panel can be expensive. However, a solar cell, the basic component that forms the solar panel, can be used to solar panel assembly. Since a hand-made solar panel is much cheaper than a commercial solar panel and its specification can be customized to meet different requirements, it is an essential knowledge to people work with solar panels. The tutorial will explain in detail how to assemble solar panels from individual solar cells to reduce cost.

Preparation and Tools

The process of solar cell assembly is not difficult yet time consuming. The tools needed are common and easy to obtain. This part of the tutorial will show the tools and parts needed for assembly and where should the solar cells be assembled.

Before soldering any solar cells, it is necessary to draw a diagram or a layout of the circuit to avoid any mistakes because once the solar cells are soldered together it is very difficult to disassemble them. And the best place for assembly is a big and flat surface. The tools and parts needed are flux pen, tab wires, buss wire, rubber gloves and a solder station. A flux pen is not required in solar cell assembly, however, it is highly recommended for beginners. Flux pen will make the soldering much faster and it will ensure the conductivity between the tab wire to each solar cell is very good. A tab wire is a flat wire that has solder on its surface, thus, no solder is needed during the soldering process. Solar cells are fragile and sensitive electric component, so when work with them it is a good habit to wear rubber gloves to prevent any damage to the surface. Otherwise, the efficiency of the solar panel will not be very high.

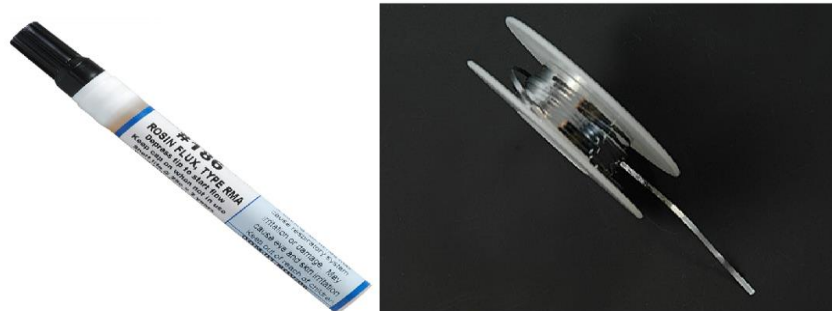


Figure 1. Flux Pen and Tab Wire

Solar Cell Assembly

Solar cells are extremely fragile, so be cautious when assemble the solar panel. In addition, the layout of the solar cell will determine the output voltage and current. Even though most of the distributors will provide product specification, it is still a good idea to test at least one of the solar cell to see the actual performance. In general, solar cells are not a stable voltage sources which means that voltage will vary when a load is added or due to any weather factors. Therefore, always put extra solar cells to you design. For example, the output voltage needs to be 12V, in the design the solar cell must has about 14 to 15V to ensure the output voltage is around 12V.

Like most of the electrical components, a standard solar cell has a positive and a negative side. The blue side which will face directly to the sun usually is the positive side. One each side, there are two or three white stripes, this is where the tab wire needs to be soldered. Sine the tab wires are flat, using a solder station that has a flat tip will help to improve the quality of the final assembly. Solar cells often has very low output voltage, therefore, it is very common to connect them in series. This means connect the blue side to the other side of the next solar cell. Be sure to leave an extra tab wire at the end to make any further connections. Do not forget to apply the flux pen first before soldering the tab wire it will increase the conductivity. Moreover, when applying the flux pen, only apply a reasonable amount because extra liquid solution from the flux pen will cover the cell surface and it will reduce the efficiency. Also, do not keep the solder touching the solar cell for too long because too much heat will degrade the solar cell and reduce its lifetime.

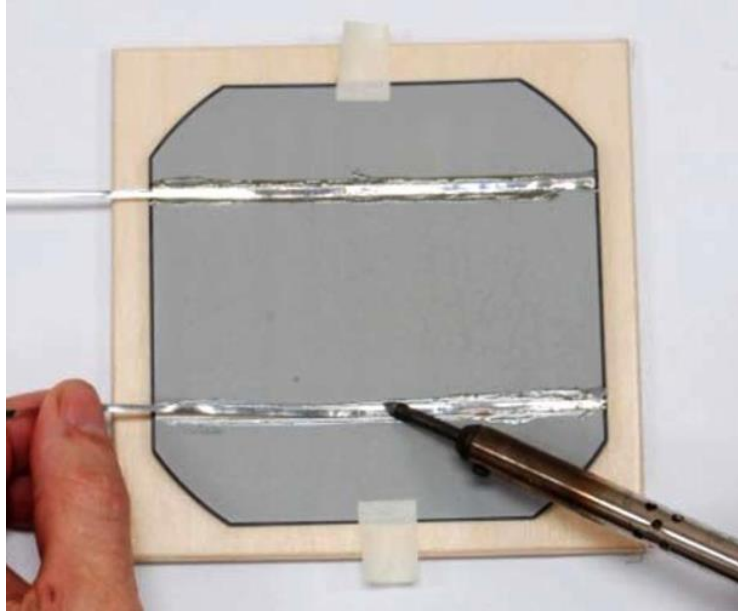


Figure 2. Example of Soldering Solar Cell

Final Assembly

After all the solar cells are soldered according to the circuit diagram. A frame that will contain all the solar cells needs to be made. Each design may require different types of frames. But in general, a frame must be good enough to protect the solar cells. Moreover, bus wires are also needed to be built into the frame to connect the tab wire to any outside sources.

The material for building the frame is not specified. But the frame needs to be water proof and to be sealed very well. The surface area can be made from glass or any other transparent materials. Some commercial panels use a glass that only allows light to travel in one direction. This will reduce the power loss from the reflection of the solar cell surface. The most common and cost efficient way to connect solar cells to a frame is to use silicon glue. It is the same material used to glue glass to any other surface. Apply a small amount of silicon glue to the negative side of the solar cells and mount them to a flat surface which will later serve as the support of the frame. Then, solder the bus wire to the positive and negative ends of the tab wire. Make sure that the wire is able to handle the amount of current from the solar cells. Next, cover the solar cell with the frame that is built for the design. Before sealing the frame, make sure that the glass is very clear as well as the solar cells.

Moreover, for some safety issues, a electrical fuse need to be connected between the buss wire and any other device that will be attached to the solar panel.

Conclusion

Solar cell assembly is a very basic skill for any solar related projects. The process is time consuming. But it will greatly reduce the cost and sometimes a project may requires engineers to customize a solar panel to meet the needs. It takes time and practice to improve the skill in order to build better and efficient solar panels.