# SOLAR BASED ELECTRICAL VEHICLES WITH CONDUCTIVE PLASTICS

**Patrapalli Durga Venkata Lakshmi[1], Make Madhu Manikya Kumar[2], Sornapudi Durga Prasad[3] kavali Sanjay Bhargav[4]**

*[1]Asst Prof ,EEE, GIET Engineering college,*
*[2,3]Asst Prof ,ECE, GIET Engineering college,*
*[4]B-Tech Scholar, GIET Engineering College, Rajahmundry, AP*

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**Abstract:** *The conversion of sunlight into electricity can be achieved using a solar cell and is one of the most attractive future source of energy. Our project describes the characteristic of an organic cell. Several characteristics which impact on the conversion efficiency of organic solar cells are discussed. Recently, organic solar cells are attracting a lot of attention due to some intrinsic advantageous characteristics like flexibility, light weight and large area applications, and significant improvement in the power conversion efficiency. For polymer- based organic photovoltaic cells, which are far less expensive to manufacture than silicon-based solar cells, scientists have long believed that the key to high efficiencies rest in the purity of the polymer/organic cell's two domains- acceptor and donor. Since production and material cost are very low, they represent a promising alternative to common solar cells which are the silicon based solar cells. Mounting these organic solar cells on Electrical Vehicles will improve the efficiency of the overall system.*

**Index Terms: solar cell, conductive plastics, electrical vehicles.**

## 1. INTRODUCTION:

When people think of solar panels they usually think of the bulky rectangle made from silicon solar cells that you can attach to a house hold roof, and that's because solar powered decals are only just starting to come around. Ambient lighting may be all you need to charge your phone. Small, thin and flexible panels created with inkjet printer can harvest energy from artificial light and sunlight.

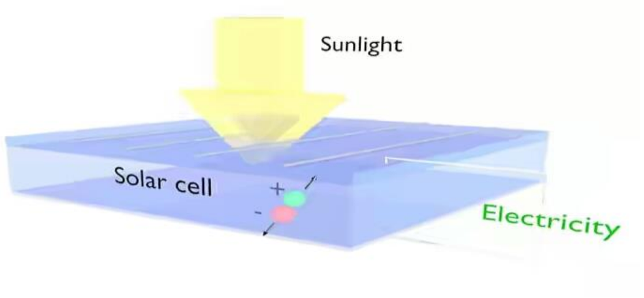


Figure 1.1 Generation of Electricity

A solar cell is a device that converts light energy in to electricity. the most common type of solar cells are made from wafers of pure silicon and boron that have been infused with phosphorous in a hot furnace coated with an anti-reflection coating and then fired with metal contact.

At the heart of the solar cell is a tiny electric field that splits negative charges from positive charges using the energy of sunlight. In a solar cell the electric field is set up with the help of small amount of other atoms. On one side of the wafer are some boron atoms and the other side are phosphorous atoms together they create a positive negative (PN) junction. Opposites usually attract, but the PN junction forms the electric field that is able to drive positive and negative charges apart. When sunlight is absorbed by the solar cell an electron is knocked free inside this silicon and pushed across the wafer due to electric field it can then be collected by metal contacts to become usable electricity.

## 2. CONDUCTIVE PLASTIC SOLAR CELLS:

As said earlier, Conventional solar panels typically use silicon to capture the sun's energy but these solar cells consists of a conductive plastic that can capture a wide range of wave lengths. This material can capture energy from indoor light which isn't possible with silicon. The panels are made up of five layers printed on top of each other a photo active layer is sandwiched between to semiconductor sheets that help a conductive ink in the outer layer to extract the charge a square module 5 cm across can be printed in about an hour. These solar cells can be tailored for a wide range of uses since they can be produced in any shape or color.

Solar cells are made by using an inkjet printer to put down the semiconductor material and electrode on to a solar cell substrate.

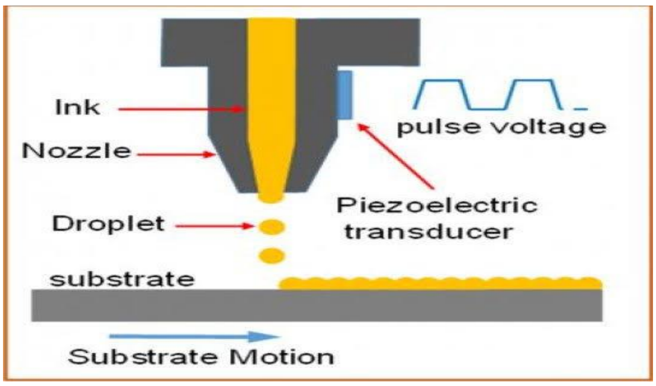


Figure 2.1 Fabrication of Solar cell

These organic cells are polymer solar cells. the most important component of the ink is the functional material , a polymer fullerene blend (in this case) these components are dissolved in an appropriate solvent additional components might be added to effect the viscosity and the surface tension of the ink for improved printability and wetting on the substrate . The printing is accomplished usually by a piezo electric driver in the nossils of the print head.

## ADVANTAGES:

- Low cost of production (because no vacuum is necessary making the equipment cheaper).
- Low fuel cost (as ink is a conductive plastic which is a low cost metal salt blend).
- Very little waste of material (because of precise patterning).
- These paper thin solar cells can be placed almost anywhere (blinds, windows, curtains, bags and almost anywhere).
- This method is environmental friendly.

## DISADVANTAGES:

- The efficiency of these solar cells are too low to be commercially viable.
- Another issue is creating a weather resistant ink that can survive harsh condition.
- Instability against oxidation and reduction, recrystallization and temperature variation can also lead to degradation and decrease performance over time.


**(a)**

**(b)**

Figure 2.2 (a) Solar Powerd Smart Backpack
(b) Solar Powerd Mobile charging

## 3. DESCRIPTION OF ELECTRIC VEHICLES & CARS:

All-electric vehicles (EVs) have an electric motor instead of an internal combustion engine. The vehicle uses a large traction battery pack to power the electric motor and must be plugged in to a charging station or wall outlet to charge. Because it runs on electricity, the vehicle emits no exhaust from a tailpipe and does not contain the typical liquid fuel components, such as a fuel pump, fuel line, or fuel tank.

Electric Cars use the energy stored in a battery (or series of batteries) for vehicle propulsion. Electric motors provide a clean and safe alternative to the internal combustion engine. There are many pros and cons about electric cars. The electric vehicle is known to have faster acceleration but shorter distance range than conventional engines. They produce no exhaust but require long charging times.

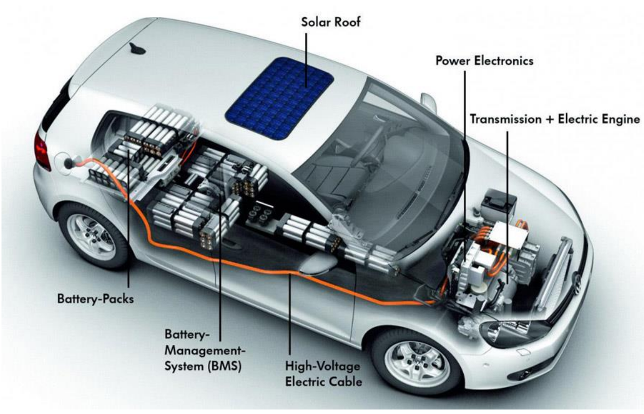


Figure 3.1 Solar cells on the top of a car

**Battery (auxiliary):** In an electric drive vehicle, the auxiliary battery provides electricity to start the car before the traction battery is engaged and also powers vehicle accessories.

**Charge port:** The charge port allows the vehicle to connect to an external power supply in order to charge the traction battery pack.

**DC/DC converter:** This device converts higher-voltage DC power from the traction battery pack to the lower-voltage DC power needed to run vehicle accessories and recharge the auxiliary battery.

**Electric traction motor:** Using power from the traction battery pack, this motor drives the vehicle's wheels. Some vehicles use motor generators that perform both the drive and regeneration functions.

**Onboard charger:** Takes the incoming AC electricity supplied via the charge port and converts it to DC power for charging the traction battery. It regulates battery characteristics such as voltage, current, temperature, and state of charge while charging the pack.

**Power electronics controller:** This unit manages the flow of electrical energy delivered by the traction battery, controlling the speed of the electric traction motor and the torque it produces.

**Thermal system (cooling):** This system maintains a proper operating temperature range of the engine, electric motor, power electronics, and other components.

**Traction battery pack:** Stores electricity for use by the electric traction motor.

**Transmission:** The transmission transfers mechanical power from the engine and/or electric traction motor to drive the wheels.

## 4. RENEWABLE ELECTRICITY AND RE CHARGING STATIONS

As plug-in hybrid electric vehicles and battery electric vehicle ownership are expanding, there is a growing need for widely distributed publicly accessible charging stations (some of which support faster charging at higher voltages and currents than are available from residential EVSEs). Many charging stations are on-street facilities provided by electric utility companies or located at retail shopping centers and operated by many private companies. These charging stations provide one or a range of heavy duty or special connectors that conform to the variety of electric charging connector standards.

## CHARGING STATIONS FALL INTO FOUR BASIC CONTEXTS:

1. **Residential charging stations:** An EV owner plugs in when he or she returns home, and the car recharges overnight. A home charging station usually has no user authentication, no metering, and may require wiring a dedicated circuit. Some portable chargers can also be wall mounted as charging stations.

Figure 4.1 Resedential charging station

**2. Charging while parked:** a commercial venture for a fee or free, offered in partnership with the owners of the parking lot. This charging may be slow or high speed and encourages EV owners to recharge their cars while they take advantage of nearby facilities. It can include parking stations, parking at malls, small centers, and train stations (or for a business's own employees).

Figure 4.2 Charging while parking

**3. Fast charging at public charging stations >40 kW,** delivering over 60 miles (100 km) of range in 10–30 minutes. These chargers may be at rest stops to allow for longer distance trips. They may also be used regularly by commuters in metropolitan areas, and for charging while parked for shorter or longer periods. Common examples are CHAdeMO (a company that designs and sells standardized chargers), SAE Combined Charging System, and Tesla Superchargers.


Figure 4.3 Showing charging at public charging stations

**4. Battery swaps or charges in under 15 minutes.** A specified target for CARB credits for a zero-emission vehicle is adding 200 miles to its range in under 15 minutes. In 2014, this was not possible for charging electric vehicles, but it is achievable with EV battery swaps and Hydrogen Fuel Cell vehicles. It intends to match the refueling expectations of regular drivers.

The vehicle is connected to the power grid through standard socket-outlets present in residences, which depending on the country are usually rated at around 10 A. To use mode 1, the electrical installation must comply with the safety regulations and must have an earthing system, a circuit breaker to protect against overload and an earth leakage protection. The sockets have blanking devices to prevent accidental contacts.

## 5. ENERGY EFFICIENCY:

Internal combustion engines have thermodynamic limits on efficiency, expressed as fraction of energy used to propel the vehicle compared to energy produced by burning fuel. Gasoline engines effectively use only 15% of the fuel energy content to move the vehicle or to power accessories, and diesel engines can reach on-board efficiency of 20%, while electric vehicles have on-board efficiency of around 80%.

Electric motors are more efficient than internal combustion engines in converting stored energy into driving a vehicle. Electric cars do not idle. Regenerative braking can recover as much as one fifth of the energy normally lost during braking.

Production and conversion electric cars typically use 10 to 23 kW·h/100 km (0.17 to 0.37 kW·h/mi). Approximately 20% of this power consumption is due to inefficiencies in charging the batteries. Tesla Motors indicates that the vehicle efficiency (including charging inefficiencies) of their lithium-ion battery powered vehicle is 12.7 kW·h/100 km (0.21 kW·h/mi) and the well-to-wheels efficiency (assuming the electricity is generated from natural gas) is 24.4 kW·h/100 km (0.39 kW·h/mi).


Figure 5.1 Charging Socket in car

Charging stations are usually connected to the electrical grid, which often means that their electricity originates from fossil-fuel power stations or nuclear power plants. Solar power is also suitable for electric vehicles. Nidec Industrial Solutions has designed a system that can be powered by either the grid or renewable energy sources like PV (50-320 kW). SolarCity is marketing its solar energy systems along with electric car charging installations. The company has announced a partnership with Rabobank to make electric car charging available for free to owners of Tesla Motors' vehicles traveling on Highway 101 between San Francisco and Los Angeles. Other cars that can make use of same charging technology are welcome.

## 6. CONCLUSION:

To reduce pollution, a battery powered electric vehicle that uses solar array to recharge will be the promising alternative to the existing system. Combining the organic solar cells with electric vehicles and developing Renewable Charging Stations at places will improve the overall efficiency. And moreover this will act as a widespread promotion for clean energy at a global level.

## 7. FUTURE SCOPE:

- **SPARC station**

The SPARC (Solar Powered Automotive ReCharging Station) uses a single custom fabricated monocrystalline solar panel capable of producing 2.7 kW of peak power to charge pure electric or plug-in hybrid to 80% capacity without drawing electricity from the local grid. Plans for the SPARC include a non-grid tied system as well as redundancy for tying to the grid through a renewable power plan. This supports their claim for net-zero driving of electric vehicles.

- **E-Move charging station**

The E-Move Charging Station is equipped with eight monocrystalline solar panels, which can supply 1.76 kWp of solar power. With further refinements, the designers are hoping to generate about 2000 kWh of electricity from the panels over the year.

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