A METHOD TO IMPROVE EFFICIENCY IN SOLAR PANEL

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ABSTRACT:

One of the renewable energy resources, solar is obtained from the solar radiations.The solar radiations are converted into electrical energy through the photovoltaic panel. The electrical yield of solar panel is mainly affected by optical and thermal losses which are caused due to reflection and temperature variations. These temperature and reflective variations also reduce the lifetime of the panel. The main intention of this work is to use anti-reflective coatings to increase the efficiency of the solar cell by increasing the electrical yield through increasing the output power and thus causing a reduction in optical losses. The antireflective chemicals like aluminum oxide and tantalum pentoxide (Al_2O_3- Ta_2O_5-Al_2O_3) are coated as a double layer. A very thin film of the chemicals is deposited on the large area of 156mm×156mm at the surface of the solar cell. By this method, the reflection loss has been reduced and efficiency has been increased. The FLIR thermal image is also included in this paper for the comparison of the results of uncoated and coated solar panel. This method is cost effective as the chemical agents used are economical which is advantageous compared to othermethods.

Keywords—heat sink, phase changing materials, efficiency.

INTRODUCTION:

Solar, one of the renewable resources can also yield electrical energy. Photovoltaic (PV) panels are used to collect the sun rays and convert them into electrical energy. But the panel's temperature rises due to radiations this in-turn affects the output power and also has a negative impact on the lifetime of the panel. Another factor that affects the output power is the reflections loss that occurs when the incidence angle differs from zero (Krauter, 2004). These losses reduce the output power which in-turn affects the overall efficiency of the panel. The main idea of this work is to increase the output power by reducing the losses. Various techniques have been used to reduce temperature and reflective losses, a detailed analysis of some methods is discussed here.

SYSTEM DESCRIPTION:

In this work, antireflective coating techniques have been proposed by using chemical agents. A detailed report of the preparation, coating, uses, and choice of the materials used for the technique is discussed here for betterunderstanding.

PREPARATION OF COATING SOLUTION:

The Coating solution is prepared by using a magnetic stirrer. To get a mixture of solution, they are allowed to mix at a particular speed in the magnetic stirrer. The stir bar inside the container rotates due to the magnetic field. Speed must be maintained at a certain rpm to avoid overflow of a solution. The solutions are sprayed on the surface of the solar cell by using an atomizer. The solutions are prepared with an appropriate concentration. The solar cell is cleaned by using the HF solution to remove the resins from the cell and then the prepared solution is sprayed on the solar cell and dried under the 100watts light for 15 minutes in a drier and then cooled under the room temperature for 10 minutes. This process is repeated for six times till each layer is coated two times.

COATING MATERIAL:

The Material used for coating a solar cell are

- HF (solution foretching)

Coating (Each 2-layercoating)

- Al_2O_3(toplayer)
- Ta_2O_5(middlelayer)
- Al_2O_3(toplayer)

PROPERTY OF THE MATERIAL:

Tantalum pentoxide has a high dielectric strength and a relatively wide band gap that makes it an excellent insulator. It has high a temperature stability of up to 1360°C. Due to high dielectric strength, it can be usedin the fabrication ofglass.

Aluminium oxide has a good thermal conductivity. It has a good strength and resists all strong acid except hydrofluoric acid and phosphorous acid. The maximum temperature withstand capability is about 2000°C. Due to good thermal properties, it can be used for a variety ofapplications.

REASON FOR CHOOSING THE MATERIALS:

They are highly nontoxic, colorless, and odorless. It has high-temperature resistance characteristic, high antireflective property, and protects the cell from cracking. Thus, by coating chemicals, the lifetime of the cell has been increased and these chemicals are easily available and cost-effective. “Passivates” the surface and reduces surface recombination.

ANTIREFLECTIVE COATING TECHNIQUE:

When light strikes the solar cell, a smallamount of solar energy is absorbed and converted into electricity. Because bare silicon cell has a high reflective index, more than 35 percent of an incident light is reflected away from the panel surface before it can be converted into usable energy. The reflection is reduced by applying an antireflective coating on the surface of the solar cell. A thin layer of dielectric material with appropriate thickness is used as an interferenceto causes the wave reflected from the anti-reflection coating top surface to be out of phase with the wave reflected from the semiconductor surfaces. Anti-reflective coating helps the solar surface to capture more light and therefore boost their efficiency. This coating decreases the light reflecting from the solar cell and increases power output to 10% to 14%. Though it may seem like a small increment it is the highest improvement of any antireflective coating achieved so far and this type of improvement can make a big difference. The coating of Al2O3- Ta2O5- Al2O3 solution on the solar cell and the glass material to protect them, they are heated under the 100watts light and cooled under the room temperature which turns into a thin layer of porous material. This makes the coating far easier and cheaper to implement. Power output and voltage output is increased. Table 1 representing various antireflective agents is shown. (Bouhafs et al., 1998; Daniel, 2008; Kazi et al.,

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