Cost-effective Solar Cells with Nanostructures (FZ1-13)

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Introduction
Photovoltaic (PV) effect is used to convert the energy of light straight into electricity. However, the flexibility of a solar cell is another problem that needs to be addressed. Today’s solar cells are usually used in flat objects such as calculators and solar panels. It would be more convenient and useful if we could produce them with high flexibility in order to improve their chance for wider application. In view of this, we will use nanomaterials and nanostructures in our project to develop a better solar cell. The use of nanostructures will allow us to fabricate solar cells with higher efficiency as well as a more narrow size. Three-dimensional nanostructures are used in our prototype since they can create light trapping at different times. Two approaches used in fabricating our samples contain high flexibility and low cost characteristics.

Methodology
We mainly focus on fabricating two different kinds of flexible solar cells: (1) ALPI substrate and (2) PI nanocnes. Both of them contained regular nano-structures which can enhance the light trapping effect whether the surface of the solar cells was flat or curved, thus the photons can then be transformed to electrical energy.

In order to make the PI solution flat, it was spin-coated on a spin-coater with 3 programs.

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Aluminum foils can be stuck to polyimide foil by a curing process. The PI solution slightly flowed to the edge of the template due to the expansion problem of the aluminum foil. The curing process of ALPI must reach at least 300℃ so most of the solvent in the PI solution can be removed. “A” was attached tightly together even after 1st etching and bending and nano spike patterns AAO formed on the surface.

We have got almost perfectly ordered Al spikes on ALPI substrates with the 20 um thick pure Al foil. For easy thickness measurement by SEM, we do 20V anodization on Al spikes to get around 5 um thick AAO.

1.2 um spike 3 hours anodisation

To make flexible polyimide nano-cones solar cells, AAO i-cone templates were fabricated as the An appropriate value of PI solution was then placed on the top of the i-cones. The PI template can be peeled off easily after curing to certain temperature in a solid state. The i-cone nano-patterns can be transferred to the PI template.

Template of AAO

1 em cone after curing to 300℃

PI cone after anodization to 500 nm

To shed light on the effect of PV thin film thickness, and the geometrical factors, reflectance spectra of NSP arrays prepared with different anodization voltages and NSP arrays coated with different PV film thicknesses were obtained.

Aim and Objective
The aim of this project is to focus on the fabricating process of solar cell with 3D nanostructure and increase the flexibility of the cells. The objectives of our project are to enhance the efficiency of the solar cells. By focusing on the fabricating process of solar cells using 3D nano-structures, we will enhance the efficiency of the solar cells. By using self-organized 3D AL nanospike arrays, we can control nanospike geometry such as height and pitch of the AL foil, such that greater efficiency will be produced.

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