Lateral Nanoconcentrator Nanowire Multijunction Photovoltaic Cells

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Global Climate & Energy Project
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Overview of process (D1, 2, space bar method)

We have developed a new method to fabricate Si nanowire (NW) photovoltaic cells that are thin, made with nanowires, and can be used in flexible solar panels. This method uses a nanoframe, a special kind of mold, to create the framework of the cell. The nanoframe is made of nanowires, which are very thin and flexible, and it is used to hold the photovoltaic materials in place.

The nanoframe is made by depositing a thin film of silicon on a substrate, then etching away the unwanted parts of the film. This process is repeated several times, each time etching away a layer of the film to create the nanoframe. The final result is a very thin, flexible frame made of nanowires.

The photovoltaic materials are then deposited on the nanoframe, typically using a process called atomic layer deposition. This process is able to deposit very thin layers of material, and it is used to create the electrodes and other components of the cell.

The cell is then assembled by connecting the photovoltaic materials to the electrodes. This can be done using a variety of methods, such as using a conductive paste to connect the materials to the electrodes.

The cell is then tested to see if it works. This can be done by measuring the current generated by the cell when illuminated with light. If the cell works, it can be used as a solar panel to generate electricity.

Results and discussion

Three DSSCs were fabricated for comparison.[2] For Cell I, bare FTO glass was used as the substrate. For solar cells II, III, the Pd pads were used as a hardmask to position the catalysts in the gaps between the antennas.

We investigated templated ss-gold growth of TiO2 nanopillar arrays and their application to x-ray sensitized solar cells (DSSCs). DSSCs with polymer solar cells deposited on TiO2 templates was investigated. DSSCs were fabricated using the functionality of the TiO2 nanowire.

Nanoporous template etched with multi-level (hardmask) masking

A 20 nitride gold hardmask was spotted on top of the hydroxy-based cross-linkable polymer layer (HBC-xil). After e-beam pre-pattern 20 ni-oxide, gold patterning was performed. High aspect ratio pillars were formed by filling the pillars with polymer after the e-beam irradiation and removing the polymer via RIE. The hardmask was then patterned as before. The resultant 500-nm-thick NFC template is shown in Fig. 1.

Ge and III-V nanowire growth for solar cells

Nanowire growth

The concept of using Ge, GaP, and InP nanowire growth for solar cells is to use the nanowire’s ability to absorb light and convert it into electrical energy. The nanowires are typically grown using the vapor-liquid-solid (VLS) method, which involves depositing a catalyst and heating it to a high temperature to promote the growth of the nanowires.

The nanowires are then used to make the photovoltaic materials of the cell. This can be done by depositing the nanowires on a substrate, such as a glass or plastic film, and then connecting the nanowires to the electrodes of the cell. The cell can then be tested to see if it works.

Results

We have demonstrated that it is possible to engineer the reactivity of metal nanoring antennas to achieve an overall decoupling of the nanowires that is required for the absorption of light. The nanowires can be grown by the vapor-liquid-solid (VLS) method and the sol-gel approach, both of which involve depositing a catalyst and heating it to a high temperature to promote the growth of the nanowires.

Conclusions and future work

The objective of this project is to develop a new type of multi-junction solar cell that can use layers of semiconductor nanowires (NW) of various bandgaps as the photovoltaic elements, i.e., the conversion of light into electrical energy. In contrast to traditional stacked multijunction cells, NWs of different bandgaps are in series. Instead of a specially designed nanoscale metamaterial to help to achieve a specific energy gap, the NW array is engineered to optimize for a particular wavelength range. The nanowires are organized by an asymmetric metasurface, such that each wavelength is absorbed by a different nanowire array. This allows the photovoltaic materials to be tuned to match the absorption characteristics of the nanowires.

The design of the solar cell is shown in the left diagram. The nanowires are grown in a different direction to form different types of NWs. This allows for the optimization of the photovoltaic performance of each layer of NWs. This is accomplished by using a combination of electron-beam lithography and chemical vapor deposition (CVD) to create the nanowires.

The device is deposited by depositing the NWs and the photovoltaic materials on a substrate. The substrate is then heated to a high temperature to promote the growth of the nanowires. The photovoltaic materials are then deposited by using a combination of electron-beam lithography and chemical vapor deposition (CVD) to create the nanowires.

The cell is then tested to see if it works. This can be done by measuring the current generated by the cell when illuminated with light. If the cell works, it can be used as a solar panel to generate electricity.

The cell can also be used to study the properties of the nanowires. This can be done by measuring the electrical properties of the nanowires, such as the resistance and capacitance, and the optical properties of the nanowires, such as the absorption and reflection.

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