Durable carbon-based electrodes for electrochemical solar cells

Electrochemical solar cells are a promising technology poised to contribute significantly to the growing demand for renewable energy. Electrochemical solar cells have had trouble gaining traction, however, since conventional implementations use expensive catalytic platinum electrodes that degrade over time, reducing their electrical output. This technology is a method for the synthesis and deposition of transparent, highly catalytic carbon nanotube electrodes that resist degradation over time. The stability of these carbon nanotubes, coupled with their transparency and flexibility make them versatile and compatible with many manufacturing methods such as roll-to-roll processing. As such, this technology furnishes a versatile electrode for electrochemical solar cells that is much more inexpensive and durable than conventional technologies.

Inexpensive and robust materials enhance the value of electrochemical solar cells

This technology achieves high catalytic performance of carbon nanotubes by treating them with ozone to induce defects at the molecular level. These defect-containing nanotubes can then be deposited at low temperature onto a wide array of surfaces. This process allows for the generation of durable and robust electrodes from inexpensive materials, obviating the need for expensive metal catalysts. This lowered production cost can be passed on to consumers, potentially increasing the product’s market share.

Moreover, this technology can be used in flexible and transparent electrochemical solar cells and is compatible with roll-to-roll processing, resulting in a low-cost process to create high performance devices.

This technology has been validated with electrochemical impedance spectroscopy and been shown to have a charge transfer resistance of 1.8 Ω cm² – a value comparable to that of platinum-based electrodes.

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Applications:

• Electrode in electrochemical solar cells
• Transparent conducting layer of electrochemical solar cells
• Electrochemical electrode in fuel cells and batteries

Advantages:

• Highly robust, showing no decay in catalytic activity over time
• Fabricated from inexpensive materials and able to replace expensive metal catalysts in conventional electrochemical solar cells
• Transparent and suitable for use in clear solar cells
• Flexible and suitable for roll-to-roll processing
• Able to serve as both the catalyst and conductor in electrochemical solar cells

Patent information:

Patent Pending (US 20090038681)

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Related Publications:


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