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Functionalising Carbon Nanotubes for Hybrid Energy Applications

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Abstract:

Carbon is a highly versatile material that allows for application specific microstructures to be designed by controlling the growth parameters. Carbons can also be tailored for applications by specific functionalisation and then attachment to other materials. Carbon nanotubes provide the ideal material platform that can be functionalised both from the inside and outside of its tubular structure, and gives maximum surface area for potential charge and energy transfer surfaces.

Nano-engineering of materials is shown to provide methodologies for efficient energy harvesting and optimum 'solid state' lighting. Key areas being developed in the quest for solution processable inexpensive large area electronics including solar cells will be introduced, and how nano-engineering of the CNT-organic hybrids can be used to create a platform for the harvesting of energy from the sun. By designing solar cells with pre-determined interpenetrating bulk heterojunctions at the nano-meter scale, where each exciton created would not need to travel more than 10nm to reach the electrodes, high efficiency cells that are inexpensive to produce could be manufactured.

Organic-inorganic systems based on carbon nanotubes (MW-) as the inorganic component will be used to demonstrate recent successes we have observed in making devices based on hybrid systems. These composite materials in the form of a solution can easily be applied to surfaces with a method such as dip-coating. The nano-engineered materials not only help in the charge carrier separation but can also increase the absorption within the materials, and be suitable for portable and flexible light-weight substrates such as plastics. Other strategies that have been examined include organic-inorganic nanorods, quantum dot based absorbers within organic matrices, and nano-engineered dye sensitised solar cells.

The use of hybrid CNT composites for enhanced charge injection in solution processed OLEDs will also be introduced with light outputs in excess of 50,000 Cd/m^2.

The scope in using nanoscale design to solve energy problems is unlimited, and we should all look towards nano-engineered materials for cheap large are electronics for quality products in the future.

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