NANOMATERIALS AND NANOTECHNOLOGIES FOR PHOTOVOLTAIC SOLAR ENERGY TECHNOLOGIES

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Abstract
Solar energy is the most abundant source of renewable energy. Solar energy is converted directly into electricity by advanced semiconductor devices called solar cells. In order to achieve high conversion efficiencies of solar cells the optical and electrical losses have to be minimized. The multi-junction concept of solar cell structures is considered a promising approach for achieving high conversion efficiencies. New absorber materials and light management are important ingredients for successful realization of multi-junction solar cells and nanotechnology plays an important role in developing them. Semiconductor quantum dots, superlattices, photonic crystals, one-dimensional (1-D) and 2-D periodic gratings and metallic nanoparticles are examples with nano-scale features that are promising candidates for realizing new absorber materials and efficient light management.

Several novel nano-materials and nano-structures will be discussed in detail such as:

i) semiconductor quantum dots as novel absorber materials

ii) plasmon scattering using metal nanoparticles,

iii) periodic surface textures and modulated surface textures for efficient light scattering,

iv) 1-D photonic crystals as back reflectors for enhanced reflection and suppression of parasitic optical losses at the back metal contact.

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