# Quantum dots and nano-porous materials for solar energy conversion

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Solar energy conversion with high efficiency and economically competitive solar cells represent the main task of many research groups [1, 2]. The fabrication of solar cells has passed through a large number of improvement steps. The first generation solar cells were based on Si wafers, mainly single crystals. Permanent researches on cost reduction and improved solar cell efficiency have led to the marketing of solar modules having 12-16% solar conversion efficiency. Application of polycrystalline Si and other forms of Si have reduced the cost but on the expense of the solar conversion efficiency.

Based on thin film technology, a second generation solar cells have been developed. Materials like amorphous Si, CIS (copper-indium-selinide) and t-Si were used and efficiencies of about 12% have been achieved with a remarkable cost reduction due to less consumption of materials.

In the last decade, a third generation solar cells based on nano-porous materials and quantum dots have been developed [3, 4]. In Kansas State University, a research group has developed solar cells based on GaAs nanoparticles. An advanced photovoltaic cell, originally developed for satellites with solar conversion efficiency of 37.3%, based on concentration of the solar spectrum up to 400 suns was developed. It is based on extremely thin concentration cells.

New synthetic strategies have been developed to design nanostructure architectures of semiconductors, metals, polymers and light harvesting assemblies. Some examples have unique optical, photocatalytic and photoelectrochemical properties of nanostructures. New sensitizer or semiconductor systems are necessary to broaden the photoresponse in solar spectrum. Hybrides of solar and conventional devices may provide an interim benefit in seeking economically valuable devices [3]. In 2008 new quantum dot solar cells based on CdSe-$TiO_2$ architecture have been developed [4]. With increasing demand for clean energy alternatives an increasing interest from private sector and venture capitalist investment could be achieved, where a major breakthroughs in developing economically viable solar energy conversion devices are expected.

**References**:

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