

IMPLEMENTATION OF NANOCARBONS IN SOLAR ENERGY CONVERSION

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Carbon is the key to many technological applications that have become indispensable in our daily life. Altering the periodic binding motifs in networks of sp^3 -, sp^2 -, and sp -hybridized C-atoms is the conceptual starting point for a wide palette of carbon allotropes.

To this end, the past two decades have served as a test-bed for measuring the physico-chemical properties of low-dimensional carbon with the advent of fullerenes (0D), followed in chronological order by carbon nanotubes (1D), carbon nanohorns, and, most recently, by graphene (2D). These species are now poised for use in wide-ranging applications.

Expanding global needs for energy have led to a significant effort to develop alternatives to fossil fuels. While alternative sources for energy are already in use, they comprise a small percentage of the energy demands needed to carry us through the 21st century. No single source will solve the global needs, but the development of photovoltaics has vast potential as a point-of-use power source. Recent work has shown that hybrid photoelectrochemical efforts with a percolation network of photon absorbers coupled to an electron/hole transporter in combination with advanced photon management are the ideal design for realizing breakthroughs in high photon conversion efficiencies suitable for the catalysis of water.

I will report on our efforts regarding a unifying strategy to use the unprecedented charge transfer chemistry of 0D fullerenes, the ballistic conductance of 1D carbon nanotubes, the semiconducting features of carbon nanohorns, and the high mobility of charge carriers in 2D graphene, together in a groundbreaking approach to solving a far-reaching challenge, that is, the efficient use of the abundant light energy around us.