

Supramolecular Assemblies of Carbon Nanohorns and Porphyrin for Photovoltaic Devices

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Carbon Nanohorns ^[1] (CNHs) represent a new type of nanostructured carbon-based material. One of the merits of CNHs different from other carbonaceous materials is a high purity due to the absence of any metal nano-particles. Thus, CNHs have attracted a great deal of attention in several fields as optoelectronic applications. ^[2]

Combination of covalent and non-covalent functionalization of CNHs is particularly promising for building donor–acceptor nanohybrids. Among various non-covalent methodologies reported, self-assembly by using an ammonium ion-crown ether interaction is regarded as one of the most powerful methods. Porphyrin / Fullerene based donor–acceptor supramolecular systems involving crown ether-ammonium interactions have been prepared for probing photo-induced electron processes. This concept has been extended to build porphyrin / SWCNT donor–acceptor nanohybrids, and occurrence of photo-induced charge separation processes is clearly demonstrated. ^[3]

Herein, we describe a supramolecular assemble of CNH covalently bonded with amino groups via spacer (sp) (CNH-sp-NH₃⁺), which is included in crown-ether appending porphyrin (Crown-ZnP). Nanohybrid CNH-sp-NH₃⁺ and the supramolecular assemble CNH-sp-NH₃⁺;Crown-ZnP were characterized by means of several techniques as HR-TEM, TGA, XPS, Raman, FT-IR and UV-vis spectroscopies. Photoinduced electron-transfer processes of the nanohybrids are confirmed on combining the time-resolved absorption and fluorescence measurements, in addition to the accumulation of viologen cation radical in solution with steady-light illumination. The efficiency of this system in photovoltaic solar cells is shown.

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