Photoconversion Using Molecularly Engineered Semiconductor-Metal Superstructures

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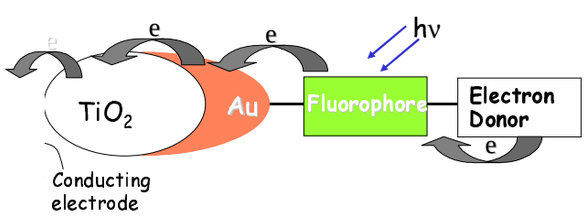
The construction of two- and three-dimensional nanoassemblies of photoactive molecules with colloidal metal and semiconductor nanoparticles provides new ways to improve photoinduced charge separation in light energy harvesting systems. Elucidation of photoinduced energy and electron transfer processes in fluorophore-metal/semiconductor nanoparticle is useful for understanding the photochemical behavior of molecules bound to metal and semiconductor nanoparticles. The nature of charge transfer interaction between excited fluorophores and metal surface dictates the deactivation pathways of the excited states.

The functionalization of gold nanoparticles with fluorophores (e.g., pyrene[1,2] and fullerene[3]) and new ways to assemble them as 3-D nanostructures (Scheme 1) will be presented. The electron transfer from the excited pyrene moiety and the gold nanoparticle has been established by monitoring the pyrene cation radical in a laser flash photolysis experiment.[2] Control of charging of gold nanoparticle plays an important role in modulating the interaction between the gold nanocore and a surface bound fluorophore. Spectrochemical and photoelectrochemical measurements that demonstrate the role of gold nanoparticle as a charge-transport mediator in such superstructures will be discussed.

Scheme 1. Photoinduced charge separation and charge transport in a semiconductor-metal-fluorophore based nanoassebly.



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Acknowledgments: The work described herein was supported by the Office of the Basic Energy Sciences of the US Department of Energy.