Semiconductor-Metal and Semiconductor-Semiconductor Nanoassembies on Electrode Surfaces

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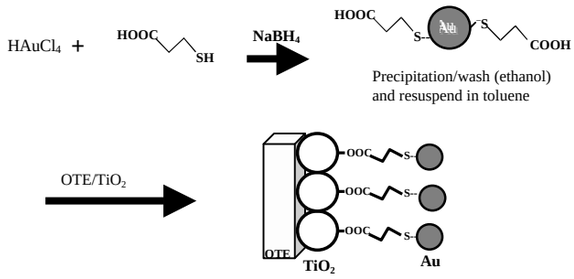
Organized assembly of metal and semiconductor nanoparticles as films provides new ways to design composite nanostructures for light energy harvesting systems [1]. In the present study, we have functionalized gold and CdSe nanoparticles on TiO_2 surface with a bifunctional surface linker. Mercaptopropionic acid having two reactive groups (-SH and -COOH groups) serves as a good linker molecule to assemble gold (or CdSe) nanoparticle on nanostructured TiO_2 surface. The principle of electrode preparation is illustrated in scheme 1.

Visible excitation of CdSe/TiO_2 films in a photoelectrochemical cell exhibit photocurrent generation indicating photoinduced charge transfer between the two semiconductor nanostructires. The gold nanoparticles in the TiO_2/Au system can be further functionalized with fluorophores to extend the response into the visible. The electron transfer from the excited fluorphore moiety and the gold nanoparticle can be modulated by applying electrochemical bias. Spectrochemical and photoelectrochemical measurements that demonstrate the role of gold nanoparticle as a charge-transport mediator in such superstructures will be discussed.



Scheme 1. Semiconductor-metal based nanoassembly on electrode surfaces.

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References

1. Kamat, P. V.; Barazzouk, S.; Hotchandani, S., "*Electrochemical Modulation of Fluorophore Emission at a Nanostructured Gold Film",* **Angew. Chem. (Int. Ed.)**, 2002. *41*, 2764-2767.