Molecular Cluster Films

C60 Films on Conducting Electrode Surface.

Electrodeposition of C_{60} films from a cluster (aggregate) solution of acetonitrile/toluene (3:1). These C_{60} cluster films cast on nanostructured SnO2 films strongly absorb visible light and exhibit excellent photoelectrochemical activity up to 700 nm.

For details on the preparation and characterization of fullerene films see:

Kamat, P. V.; Barazzouk, S.; Thomas, K. G.; Hotchandani, S., Electrodeposition of C60 Clusters on Nanostructured SnO2 Films for Enhanced Photocurrent Generation. J. Phys. Chem. B, 2000, 104, 4014-4017.

Kamat, P. V.; Barazzouk, S.; Hotchandani, S., Nanostructured Fullerene Films. Adv. Mater., 2001, 13, 1614-1617.

Barazzouk, S.; Hotchandani, S.; Kamat, P. V., Unusual Electrocatalytic Behavior of Ferrocene Bound Fullerene Cluster Films. J. Mater. Chem., 2002, 12, 2021-2025.

A known amount (~2 mL) of cluster solution (0.11 mM) was transferred to a small cell in which two optically transparent electrodes were kept at a distance of ~6 mm using Teflon spacer, and a DC voltage (50-200V) was applied using a Fluke 415A High Voltage DC power supply. Within 30-60 seconds the solution turned colorless as all the C*60* clusters were deposited as a brown film on the electrode connected to the positive terminal of the source. The thickness of the film could be varied by changing the concentration of the C_{60} clusters or varying the time of deposition. The film was then thoroughly washed with acetonitrile. Unless otherwise specified the amount of C_{60} deposited on the film was 0.2 □moles/cm^2 (approx. 1□m in thickness). A similar method was employed to cast films of C_{60} clusters on nanostructured SnO*2* and TiO*2* electrodes.

Porphyrin and Porphrin-C_{60} Composite Films.

A known amount (~2 mL) of H_2P, C_{60} or mixed cluster solution in acetonitrile/toluene (3/1, v/v) was transferred to a 1 cm cuvette in which two electrodes (viz., OTE/SnO_2 and OTE) were kept at a distance of ~6 mm using a Teflon spacer. A dc voltage (500V) was applied between these two electrodes using a Fluke 415 power supply. The deposition of the film can be visibly seen as the solution becomes colorless with simultaneous brown coloration of the conducting glass electrode. Deposition of thin SnO_2 colloidal film prior to electrodeposition yields uniform and robust coverage of C_{60} or porphyrin

For further details on the properties of these films see:

Hasobe, T.; Imahori, H.; Fukuzumi, S.; Kamat, P. V., Light Energy Harvesting Using Mixed Molecular Nanoclusters. Porphyrin and C60 Cluster Films for Efficient Photocurrent Generation. J. Phys. Chem. B, 2003, 107, 12105 - 12112.

Hasobe, T.; Imahori, H.; Kamat, P. V.; Fukuzumi, S., Photovoltaic Cells using composite nanoclusters of porphyrins and fullerenes with gold nanoparticles. J. Am. Chem. Soc, 2005, 127, 1216-1228.

Hasobe, T.; Kamat, P. V.; Troiani, V.; Solladie, N.; Ahn, T. K.; Kim, S. K.; Kim, D.; Kongkanand, A.; Kuwabata, S.; Fukuzumi, S., Enhancement of Light-Energy Conversion Efficiency by Multi-Porphyrin Arrays of Porphyrin-Peptide Oligomers with Fullerene Clusters. J. Phys. Chem. B, 2005, 109, 19-23.