Photoinduced Electron Transfer Between Fullerene Clusters, and *bis*- diphenylstilbene.

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Intermolecular photoinduced electron transfer (PET) between C_{60} clusters, and *bis*- diphenylamino stilbene that functions as electron donors was measured in dilute solution. The temporal behavior of the system was followed by transient absorption using both step scan Fourier transform spectroscopy and dispersive techniques following a 5 ns, 2 mJ, 532 nm laser pulse.

C_{60} clustering was first evidenced by a change in $^3C_{60}$ lifetime as a function of sample age (Figure 1). Freshly mixed sample containing 0.1 mM each of C_{60} and *bis*- diphenylamino stilbene in benzonitrile exhibited a 2.14 μs lifetime appropriate for diffusion limited collisional quenching with the electron donor. After a few days of aging, the same sample showed a biexponential $^3C_{60}$ decay with the fast component having a dominant amplitude and a lifetime of 0.7 μs. Months of aging results in a distinctly non-exponential decay that can be reasonably well fit with a biexponential function having τ_{fast} = 0.6 μs and τ_{slow} = 6 μs.

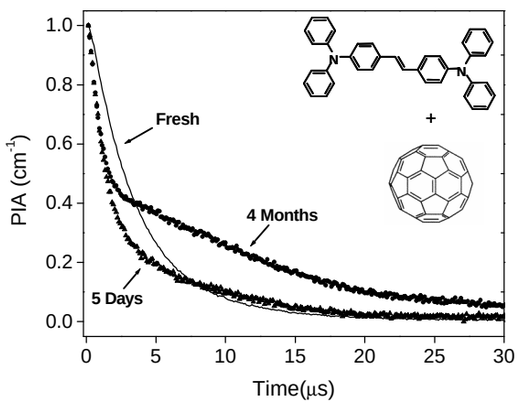

Figure 1. $^3C_{60}$ decay dynamics caused by electron transfer with the diphenylamino stilbene donor as a function of sample age. Freshly mixed, 5 day old, and 4 month old samples are shown.

The presence of a quenching process that is *faster* than the diffusion limit for the two monomers in solution strongly suggests association of the donor and acceptor molecules, yet further aging generates a component that is slower than the solution diffusion limit. Dynamic light scattering indicates cluster formation does occur and that the cluster dynamics are fairly complicated. Samples that are a few days old show cluster formation with an average cluster size on the order of 400 nm, consistent with literature reports of C_{60} cluster size in polar solvents. Samples that are several months old show a bimodal distribution with modes of 200 nm and 900 nm.

The amplitude of the fast component in the biexponential decay then correlates with formation of clusters in the 200 – 400 nm diameter range. The slow component correlates with formation of the larger cluster. Electron transfer rates and quantum efficiencies both depend on cluster size and models for the photoinduced electron transfer mechanisms in the clusters will be discussed.