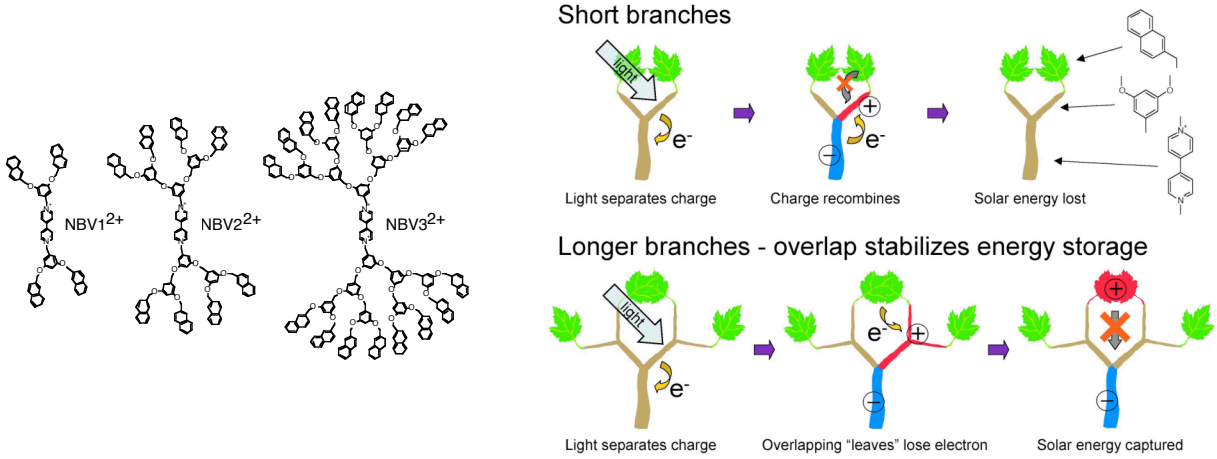
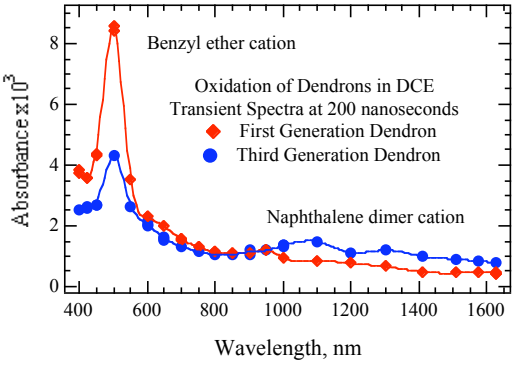
Storing Energy in Dendrimer Trees: Stabilizing Charge Separation in Dendrimers

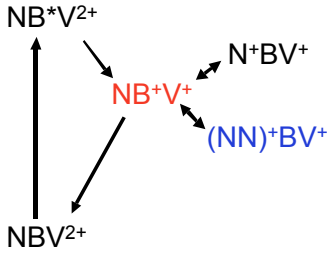
Featured in the President's FY 2005 Budget Request to Congress
(DOE/Science/Basic Energy Sciences/Chemical Sciences, Geosciences, and Biosciences)



Dendrimers (above left) are nanoscale molecules constructed from branches connected to a central core. If a dendrimer is built with an electron acceptor in the core and electron donors on the branches, the molecule can capture and temporarily store energy from light by moving electrons from the branches to the core. Further chemistry can then be used to capture the energy permanently before it is dissipated by electron transfer back to the branches. A dendrimeric system has been designed that functions as an electron antenna, absorbing several photons to create a core with a long lifetime. The stored energy can be lost if the electron returns to the "hole" it left behind. However, for dendrimers with branches long enough to allow their tips to touch, the holes are trapped on pairs of molecules at the tips, and the charge-separated state lasts for a long period of time.

Pulse radiolysis experiments at BNL's Laser-Electron Accelerator Facility demonstrate the importance of the touching "leaves" (see below). Oxidation of the first-generation dendrimer fragment (dendron) results in oxidized benzyl ether branches B^+, whereas oxidation of the third-generation dendron produces more naphthalene dimer cation $(NN)^+$ "leaf pairs."





For details see: *A Dendrimer-Based Electron Antenna: Paired Electron Transfer Reactions in Dendrimers with a 4,4'-bipyridine Core and Naphthalene Peripheral Groups* T. H. Ghaddar, J. F. Wishart, D. W. Thompson, J. K. Whitesell, and M. A. Fox *J. Am. Chem. Soc.* **124,** 8285-8289 (2002)

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