Investigation on Novel Photoactive Carbon Materials for Their Unique Properties Relevant to Energy Conversion

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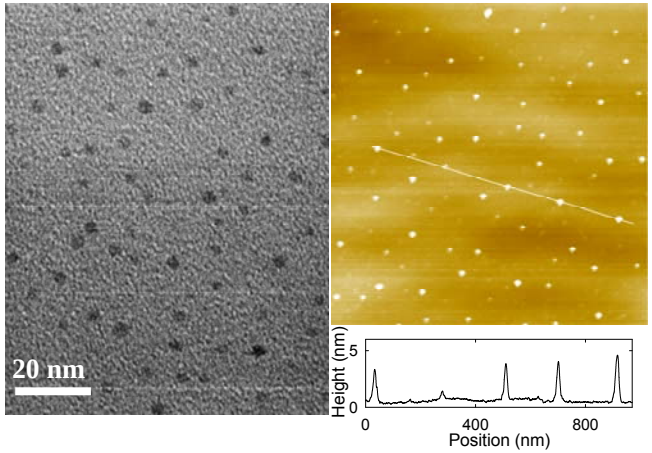
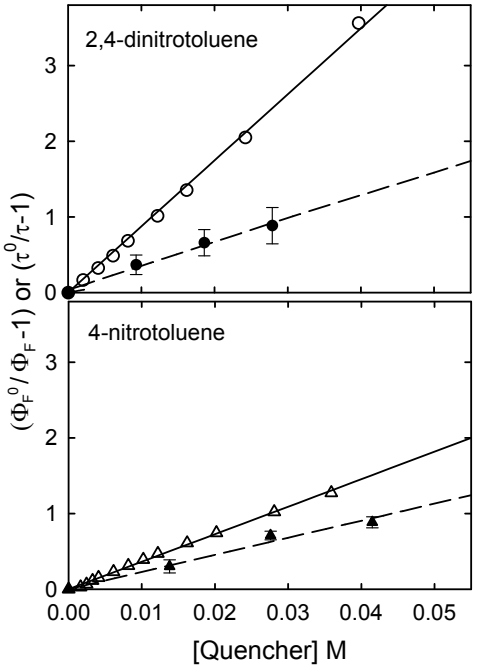
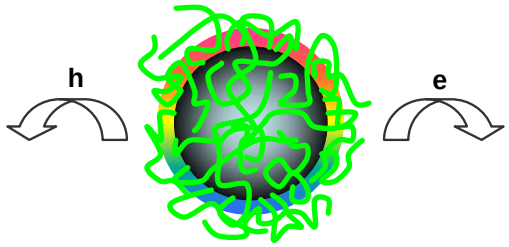
The photoluminescence in carbon dots (surface-passivated small carbon nanoparticles) could be quenched highly efficiently by either electron acceptor or electron donor molecules in solution, namely that the photoexcited carbon dots are both excellent electron donors and excellent electron acceptors, thus offering new opportunities in potentially using carbon dots for light energy conversion and related applications, as well as in mechanistic elucidation of the photoluminescence.



TEM (left) and AFM (right) images of the carbon dots used.





LEFT: Stern-Volmer plots for the quenching of luminescence quantum yields (400 nm excitation) of the carbon dots by 2,4-dinitrotoluene (○) and 4-nitrotoluene (△) in toluene; and plots for the quenching of luminescence lifetimes (407 nm excitation) by 2,4-dinitrotoluene (●) and 4-nitrotoluene (▲).

RIGHT: Stern-Volmer plots for the quenching of luminescence quantum yields (400 nm excitation) of the carbon dots by DEA in methanol (○) and chloroform (□), and for the quenching of luminescence lifetimes (407 nm excitation) in methanol (●). The low-concentration portion of the same plot for diethylamine as the quencher in methanol (-.-.-) is also shown for comparison.