

**2011 Iota Sigma Pi Anna Louise Hoffman Award for Outstanding Achievement in  
Graduate Research  
Sondra Hellstrom**



Ms. Sondra Hellstrom, an outstanding graduate student of Dr. Zhenan Bao of Stanford University, is developing and characterizing suitable materials for flexible transparent electrodes, which are critical for use in large-area flexible touch screens, solar cells, and flat panel displays. In addition to her many publications, she has one provisional patent, an indication of the importance of the work. Ms. Hellstrom writes about her work: "One approach to preparation of alternative transparent electrodes involves formation of a thin or porous film of material with ultrahigh conductivity. A promising candidate is the carbon nanotube (CNT) network. Carbon nanotubes have typical mean free paths of more than 1 micron, can be cast from solution onto flexible substrates, and have excellent mechanical properties. There are, however, at least two key challenges to using CNT networks for electrodes. The first is that transport through a CNT network is dominated by large junction resistances between nanotubes. The second is that, in solution, strong van der Waals forces between CNTs drive aggregation into bundles, which are markedly less efficient conductors than single tubes. My aim has been to develop composite materials that address each of these challenges. To address the second, I have explored the use of regioregular poly-3-hexylthiophene (rr-P3HT) as a nanotube dispersing agent. rr-P3HT disperses carbon nanotubes at lower surfactant concentrations than more common CNT surfactants; it is also more conductive, especially when doped, making these composites promising for transparent electrodes." In a letter of support for Sondra, Dr. Michael D. McGehee writes that Sondra has been chosen to be the lead on a review article because of her superior writing skills and organizational ability. Furthermore, he goes on to say that Sondra is in the top 5% of PhD students at Stanford.