

# Improving Polyaniline Conductivity Through Controlling the Size and Size Distribution of Its Template

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Session 2, Talk 2 (11:00 AM)

Polyaniline (PANI) is an attractive candidate for organic and polymer electronics because of its high electrical conductivity when doped with molecular acids [1-3]. Its utility, however, has been restricted by processing and patterning limitations due to the limited solubility of molecular acid-doped PANI in common solvents.

To improve its processability, we have investigated PANI that is template synthesized in the presence of a polymer acid, poly(2-acrylamino-2-methyl-1-propanesulfonic acid), PAAMPSA. In addition to doping PANI, excess pendant sulfonic acid groups can impart solubility to the material. The resulting PANI is therefore not only electrically conductive, but also easily processable from aqueous dispersions. During the course of aniline polymerization, PANI-PAAMPSA forms particles depending on the molecular characteristics of the polymer acid template. Specifically, templating aniline polymerization with a higher molecular weight PAAMPSA results in bigger PANI-PAAMPSA particles; templating aniline polymerization with a broader molecular weight distribution PAAMPSA results in particles with a larger size distribution. Additionally, PANI is preferentially segregated to the surface of these particles. The conductivity of drop-cast films of PANI-PAAMPSA therefore depends on how the particles pack in the solid state. In particular, we find the conductivity of PANI-PAAMPSA to increase with particle density, and accordingly, with the surface area per unit volume of the cast film.

For better performance of the electronic devices with PANI-PAAMPSA, we further improved the conductivity of PANI-PAAMPSA by more than two orders of magnitude post-synthesis by exposing it to dichloroacetic acid (DCA). DCA moderates the ionic interactions between PANI and PAAMPSA, allowing the structures with particles arrested during template polymerization to relax. PANI-PAAMPSA thus adopts a conformationally more favorable structure that dramatically enhances charge transport.

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