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Polymer Conductivity through Particle Connectivity YUEH-LIN LOO, Princeton University — To promote solution processability of conductive polymers, polymer acids, instead of small-molecule acids, are frequently used as dopants. Generally, the conductive polymer is synthesized in the presence of the polymer acid; sub-micron size particles that are electrostatically stabilized result during polymerization. We discovered that the molecular characteristics of the polymer acid have great implications on the structure of these conductive polymer particles. Templating the synthesis of the conductive polymer with a higher molecular weight polymer acid results in larger particles, and templating with a polymer acid having a larger molecular weight distribution results in a large size distribution in the particles. Because conduction in such conductive polymers is governed by how these particles pack, we show that the macroscopic conductivity of these films is dictated by a single parameter, i.e., the particle density, that is reducible from the various molecular characteristics of the polymer acid we explored. In the specific case of polyaniline that is doped with poly(2-acrylamido-2-methyl-1-propane sulfonic acid), the particles are structurally and chemically inhomogeneous. The conductive portions of the polymer preferentially segregate to the particle surface. Conduction in these materials are therefore mediated by the particle surface and conductivity thus scales superlinearly with particle surface area per unit film volume.

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