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SEM technique for imaging and measuring electronic transport in nanocomposites based on electric field induced contrast

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Technology Summary

This invention is used to locate, image, and measure electronic transport through conductive pathways in thin film nano-composite materials. It is a technique utilizing high resolution SEM technology in which high electric fields are induced in order to distinguish regions within a thin film that carry current from those that are insulating. The spacial resolution of the information is on the order of that for the SEM. In addition, this invention includes a calibration process to correlate brightness to local potential so that the degree of local conductivity can be assessed quantitatively. In this technique, voltage is applied to the network through electrodes while inside the SEM. Conductive pathways, which could be of the form of a percolation network of nanoparticles, nanowires, or nanotubes etc., in contact with the electrodes acquire some of the applied potential. The sample geometry is important to operation of this method and has been designed so that large electric fields are generated from relatively small applied biases. This is important since large voltages can easily destroy such small percolation networks. This invention is particularly useful in the realm of plastic electronics in which it has been shown that the addition of nanomaterials greatly enhances overall properties. This technique can be used to assess, in-situ, the density, dispersion, and orientation of additives along with information about their role in enhancing electronic properties of the bulk.

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