PEDOT:PSS NANOCOMPOSITES FILMS WITH GRAPHENE OXIDE AND NITROGEN DOPED MULTIWALL CARBON NANOTUBES WITH n-TYPE THERMOELECTRICAL PROPERTIES.

Ruben Sarabia-Riquelme, Ignacio Martin-Gullon, Matthew C. Weisenberger.

University of Kentucky – Center for Applied Energy Research

2540 Research Park Drive, Lexington KY 40501

Conductive polymers have received increasing attention in the last years because of their potential use in flexible thermoelectric devices. The figure of merit, and its derived power factor, are some orders of magnitude lower to those of traditional inorganic semiconductors such as Bi_2Te_3. Nevertheless, conductive polymers such as PEDOT:PSS are considerably more economic and can be solution-processed as a film, for instance by spray-coating. PEDOT:PSS presents p-type semiconductor behavior, however, a complete thermoelectric device needs both p- and n-type legs. It is known that nitrogen doped multiwall carbon nanotubes (N-MWCNT) present n-type behavior. The present works deals with the development of nanocomposites of N-MWCNT and PEDOT:PSS with overall n-type characteristics and keeping the flexibility of a polymer film. A set of composites ranging from 0 to 100% N-MWCNTs were fabricated, yielding satisfactory n-type behavior at N-MWCNT content of 60 wt.% and above. Further, it is also known that little amounts of graphene oxide (GO) enhance the thermoelectric properties of PEDOT:PSS. Thus, another set of experiments was done with hybrid PEDOT:PSS nanocomposites with 60 wt.% of N-MWCNTs and 0.5-5 wt.% of GO. GO aids the formation of a much more stable PEDOT:PSS/N-MWCNT dispersion, yielding more homogeneous films. The improved homogeneity resulted in more efficient charge transfer, and a considerable enhanced power factor than in the GO-free nanocomposite films was observed.