# QUASI-ONE-DIMENSIONAL ELECTRONIC TRANSPORT PROPERTIES OF CONDUCTING POLYMER NANOWIRES

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*To my teachers*

## Abstract

This thesis reports the study of the Charge Density Wave (CDW) state in polypyrrole (PPy) and composite gold-polypyrrole (AuPPy) nanotubes. Here we have presented the synthesis of the both pure and composite PPy nanotubes and results of electronic transport property studies. A brief description of techniques used for characterization of these nanotubes is given. Details of electronic transport properties of these nanotubes is presented in subsequent chapters. Magneto-transport and hard x-ray photoemission spectroscopy measurement results reveal that the disorder increases but doping reduces in both PPy and AuPPy nanotubes with the decrease of nanotubes-diameter. But due to gold incorporation the disorder as well as doping reduces. The reduction of disorder and doping in the system increases the stability of CDW state in gold-incorporated nanotubes. Low temperature dielectric measurements of PPy nanotubes revel that the dielectric constant is of the order of $10^3$, which is the usual situation for a CDW state. Relaxation time for the dielectric loss peak $\tau_0(T)$, whose temperature dependence scales with low bias DC conductance, both showing Arrhenius behavior with a gap of around 3.5 meV. These are classic phenomena observed in various conventional CDW materials. We have tuned the CDW state in these PPy nanotubes by incorporating gold nanoparticles and studied its effect using dielectric spectroscopy. We have shown by x-ray scattering technique that the static value of dielectric constant in PPy nanotubes can be tuned to a colossal value by tuning the wt% of gold nanoparticles. Switching transition observed here for both types of nanotubes have been shown to be of metal-insulator type transition using PPy nanotubes by studying magnetoresistance and Zabrodskii plots.

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