# Nanocomposites and nanomaterials

## Nanocomposites of polypyrrole with carbon nanotubes

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Polypyrrole (PPy) is an intrinsically conducting polymer with unique set of physical and chemical properties. Specifically, it is characterized with high conductivity and chemical stability, interesting redox and sensing properties, etc. From application point of view these important features match well with a low cost and ease of synthesis of this polymer. As a consequence, PPy finds usage in batteries, gas sensors, antistatic and EMI shielding applications, etc. However, PPy has such drawbacks as poor mechanical properties and processability. One of efficient solutions of these problems is its application in a form of its nanocomposites with various organic or inorganic materials. A particular attention is paid to using carbon nanotubes (CNTs) as a second component of the nanocomposites due to their high conductivity, strength and large surface area. Therefore, the composites of PPy and CNTs (PPy-CNTs) due to unification of properties of the both components could be effectively appllied in various areas as nanocarriers for targeted drug delivery in living cells, chemical and biochemical sensing, antistatic protection, electromagnetic interference shielding, photovoltaics, etc. In line with this point we report results of work devoted to preparation and properties of new PPy-CNTs nanocomposites. These nanocomposites were synthesized by chemical oxidative polymerization of pyrrole in CNTs water dispersions. Our work was concentrated on investigation of effects of the polymerization conditions on formation and physical-chemical properties of the nanocomposites. In particular, we considered effects of temperature, concentration of the initiator and pyrrole as well as of pyrrole/CNT weight ratio on the polymerization specificity. Using pH and open-circuit potential monitoring of the polymerization, we showed the effect of these factors on kinetics of the nanocomposites formation. FTIR spectra of the nanocomposites revealed an interaction between the nanocomposite components (PPy and CNTs). Transmission electron microscopy and X-Ray diffraction methods confirmed core-shell morphology of the nanocomposites and specific structure of PPy localized in the thin shell. It was found that these nanocomposites are conductive, sensitive to different gases and have high thermal stability that suggests their applications as antistatic and sensor materials.