SYNTHESIS AND MORPHOLOGICAL CHARACTERIZATION OF CONDUCTING PPy AND PPy/$CeCl_3$COMPOSITE

[1]N.S.Dixit, [2]S.G.Khobragade

[1]Assistant Professor, [2]Assistant Professor

[1]Department of Chemistry, G.S.Tompe Arts, Commerce & Science college, Chandur Bazar, Amravati (M.S.) India
[2]Department of Chemistry, Brijlal Biyani Science College, Amravati-444605 (M.S.) India

Abstract : Conducting Polypyrrole and Polypyrrole/$CeCl_3$ dye composites were synthesized by using simple oxidative polymerization method by using ammonium peroxydisulphate as an oxidizing agent with simultaneous doping during the synthesis at 0.01 M and 0.2 M concentrations of dopant$CeCl_3$. Morphological characterization of synthesized composites was carried out by XRD technique. These studies suggest that they exhibit amorphous behavior and change in surface morphology due to insertion of dopant.

Key words: Polypyrrole, Polypyrrole/fluoroscein, APS.

Introduction:

Conducting polymers and their composites have become increasingly important for technical applications and the use of organic or inorganic fillers (dopants or composites) can prepare a new polymeric material with interesting combinations of physical mechanical and electrical properties. Among all organic conducting polymers polypyrrole is one of the most promising materials for multifunctionalised applications. For the commercial use of this conducting polymer, a complete understanding of its properties is necessary. The conducting properties of Polypyrrole are not only depend upon nature,concentration and oxidation state of dopant but also on doping level with type and concentration of different types of oxidant used. The properties of the polymers can be modified by adding various concentrations of different types of dopant to their structure.[1-3]

In this present research work conducting polymer Polypyrrole/$CeCl_3$composite was synthesized through chemical oxidative polymerization route by using ammonium peroxydisulphate as an oxidant at lowtemperature.The monomer to oxidant ratio was 1:1M. The concentration of $CeCl_3$ was varied from 0.01 to 0.2M. All the composite samples were characterized through X-ray diffraction Analysis.[4-7]

Experimental:-

All the chemicals required in the present work like monomer pyrrole, oxidizing agent, ammoniumperoxydisulphate and dopant $CeCl_3$ are of A.R.Grade. Polypyrrole/$CeCl_3$ composites were synthesized by simple chemical oxidative polymerization method. The aqueous solution of 0.1 MAmmonium peroxydisulphate was added to the 0.01M aqueous solution of dopant$CeCl_3$ with constant stirring. After a vigorous stirring at 50^{o}C drop by drop 0.1 M solution of monomer pyrrole was added. The reaction was stirred for few hours on magnetic stirrer which gives rise to formation of precipitate of polymer composite. This reaction mixture was allowed to stand for 24 hours in order to complete polymerization process. The resulting product was vacuum filtered. The precipitate was washed with copious amount of triply distilled water. Until the washing was clear. Similarly 0.2 M Polypyrrole/$CeCl_3$ composite was also synthesized. The synthesized product was further characterized by X-ray diffraction.

Result and discussion:-

The morphological characterization of Polypyrrole/$CeCl_3$ composite was carried out through X-ray diffraction technique.

The XRD spectra of PPy, PPy/$CeCl_3$ composite at 0.01 and 0.2 M concentration of $CeCl_3$ is given in fig. which shows that PPy (pure), exhibits a broad characteristic peak at around 2θ =26.15º, this peak is corresponding to highly disordered region, which indicates amorphous nature of PPy. This can be attributed to scattering of x-ray from all over chains of PPy. The peak pattern obtained in PPy composites of $CeCl_3$ is same as in case of PPy which indicates basic polymer structure is retained after doping.

The long chains of the PPy makes it difficult for the orderly packing of chemically modified PPy and thus the crystalline nature of the chemically modified PPy is not possible. Thus chemically modified polypyrrole with $CeCl_3$ leading to amorphous nature of Polymer composite.

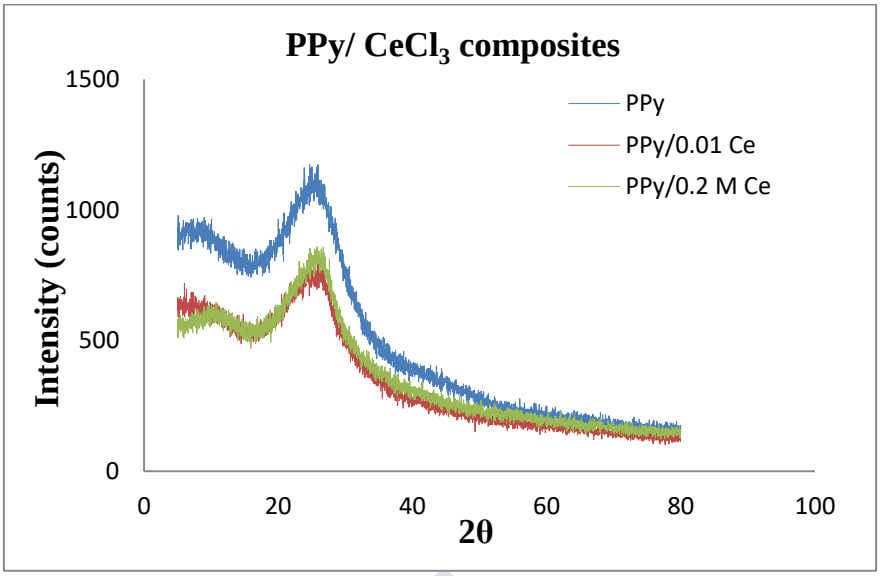

Fig : XRD diffractogram of PPy/$CeCl_3$ composites

With the variation $CeCl_3$ concentrations i.e., from 0.01-0.2 M the PPy spectra look almost similar but with peaks shifted towards lower diffraction angle (25.18 and 23.09^0 in case of 0.01 and 0.2 M dopant concentration of $CeCl_3$) as compared to PPy (Pure). The shifting of peak towards lower diffraction angle is attributed to formation of quasi particle polarons and bipolarons which improves and enhances Polypyrrole morphology.

Conclusions:

Efforts have been made to synthesize the polypyrrole/$CeCl_3$ composites to tailor the structural, morphological, and electrical properties of polypyrrole. Detailed morphological characterizations of the synthesized composites through XRD studies indicate the incorporation of dopant into the polymeric chain. The XRD study indicates the amorphous nature of the samples and the presence ofsimilar hump in the diffractogram indicates the homogeneous nature of the polymer.

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