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Structural Characterization of Fe_3O_4 Nanoparticle Embedded Polypyrrole-$Fecl_3$ Composite

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Abstract: *The conducting polymer composites have generated lot of scientific interest and led to active multi-disciplinary research because of their excellent potential for technological applications. Among the conducting polymers, Polypyrrole (PPY) and its composites have attracted considerable attention because they are easily synthesized. There are many approaches in the enhancement of the mechanical strength, chemical stability and gas-sensing properties by combining PPY with organic and inorganic materials to form composites. The composite of the various combinations of ratios the Pyrrole to $FeCl_3$ with the Fe_3O_4 nano particles. The composite prepared in the form of powder. The powder of composite is prepared through Chemical polymerization method. The sample preparation starts from distillation of Pyrrole with various combination of Pyrrole to $FeCl_3$ are stirred for overnight. The distillation of Pyrrole for purification of Pyrrole, we have designed the Portable Distillation Set up which 100% save the wastage of water used for the cooling of vapor in Condenser. Also the Fe_3O_4 nano particles are added for the blending purpose. The solution is then processed in centrifugal machine and filtered to separate the composite particles from the solution. The powder is dried in the furnace at warm temperature. Also the composite is exposed to room temperature for sufficient time. The dried powder sample is analyzed through XRD.*

Keywords: PPY, XRD

I. Introduction

The key property of most polymers, which distinguishes them from metals, is their inability to carry electricity. Whereas, the insulating properties of polymers are a significant advantage for many applications of plastics. During the past 25 years, however, a new class of organic polymers has been devised with the remarkable ability to conduct electrical current. Part of a larger class of materials called “synthetic metals”. Some of these conductive plastics are already under development for practical applications. A major obstacle to the rapid development of conductive polymers has been the lack of understanding of how electrical conductivity works in these polymers. An understanding of the relationship between the chemical structure of the repeating unit of the polymer and its electrical properties would enable the electronic and mechanical properties of these materials to be tailored at the molecular level.

II. Synthesis and Analysis of Composite

The composite of the various combination of ratios the Pyrrole to $FeCl_3$ with the Fe_3O_4 nano particles are prepared. The composite thus prepared in the form of powder. The powder of composite is prepared through Chemical polymerization Method. The sample preparation starts from distillation of Pyrrole. With various combination of Pyrrole to $FeCl_3$ are stirred for overnight. Also the Fe_3O_4 nano particles are added as the blending purpose. The solution is then processed in centrifugal machine and filtered to separate the composite particles from the solution. The powder is dried in the furnace at warm temperature. Also the composite is exposed to room temperature for sufficient time. The dried powder sample are analyzed through XRD. FTIR of the same samples are done. The pellet are prepared from the powder using KBr press for further experimental process.

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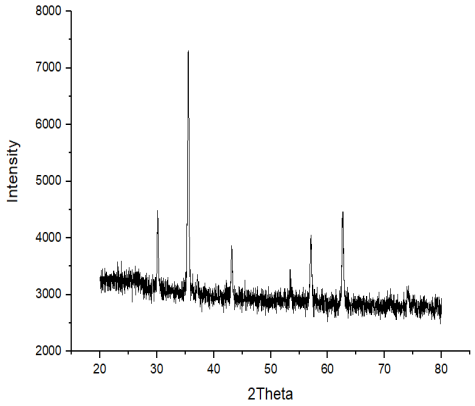

Figure 1: XRD for sample : Pyrrole (1ml) + $FeCl_3$ (1gm)+Fe_3O_4 (0.3gm)

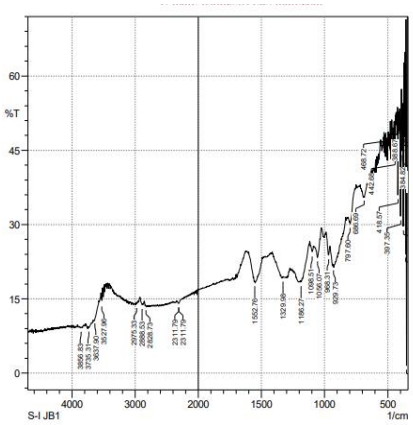

Figure 2: FTIR for Sample : Pyrrole (1ml) + $FeCl_3$ (1gm)+Fe_3O_4 (0.3gm)

III. Conclusion

The XRD pattern shown in Figure 1 gives information that the Peak are obtained at the 30.034°, 35.410°, 43.038°, 53.379° and 56.911° are similar that with obtained for pure Fe_3O_4 which confirm the presence of Fe_3O_4. The FTIR spectra of PPy and the Fe_3O_4–PPy composite is shown in Figure 2. PPy–Fe3O4 composites were prepared with the chemical polymerization method. The properties of the PPy–Fe_3O_4 particles were influenced by the concentration of $FeCl_3$ solution, which was used to disperse Fe3O4 particles.

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