MIXED CONDUCTING POLYPYRROLE-MONTMORILLONITE NANOCOMPOSITES PREPARED BY SPONTANEOUS POLYMERIZATION OF PYRROLE

R.M.M.Y. RAJAPAKSE,[1] R.M.G. RAJAPAKSE,[1]
H.M.N. BANDARA[1] AND B.S.B. KARUNARATHNE[2]

[1]*Department of Chemistry,* [2]*Department of Physics, Faculty of Science, University of Peradeniya*

Sodium montmorrilonite (MMT), alternatively referred to as 2:1 layered silicates possess the same structural characteristics as the well-known minerals talc and mica. Their crystal structure consists of two silica tetrahedral sheets fused to an edge-shared octahedral sheet of nominally aluminium or magnesium hydroxide. Weak dipolar and van der Waals forces separate the layers, forming interlayers or galleries which are normally occupied by cations balancing the charge deficiency that is generated by isomorphous substitution within the layers. Depending upon the precise chemical nature of the cation, a variety of polymers, both polar and nonpolar, can be intercalated into the interlayer region. Cu(II) ions can be inserted in to MMT by ion exchange to obtain Cu^{2+} intercalated MMT, [Cu(II)-MMT]. Pyrrole once introduced, undergoes spontaneous polymerization within the clay intergalleries by Cu(II) ions, the latter reduced to Cu(I) resulting Cu(I)-polypyrrole-MMT nanocomposite. The *d* spacing of the (001) layer due to Polypyrrole, (PPY) is 17 A and it does not change upon heat treatment. DC polarization test shows both electronic and ionic conducting nature of the composite. The ionic and electronic transport numbers are 0.61 and 0.39 respectively. Furthermore, the AC impedance analysis shows the temperature dependence of conductivity and the plot of log [Conductivity, S cm^{-1}] vs 1000/ T, K^{-1} is a straight line in the temperature range of 303 K to 363 K ranges. The activation energy obtained from the Arrhenius plot is 0.102 eV. As the H^+ concentration is increased, during the sample preparation while keeping constant concentration of pyrrole and clay, the bulk conductivity of the nanocomposite increases.

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