

Electrical Conductivity of Newly Synthesized Copolymer Resin-IV from 2, 4-Dihydroxypropiophenone, 1, 5-Diaminonaphthalene and Formaldehyde

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Abstract: The copolymer 2,4-DHP-1,5-DANF-IV has been synthesized by condensation of 2,4-dihydroxypropiophenone, 1,5-diaminonaphthalene with formaldehyde in the presence of 2M hydrochloric acid as a catalyst with 4:2:7 molar ratio of reacting monomers. The copolymer has been characterized by elemental analysis, UV-Visible, FT-I and ¹H-NMR spectra. Electrical conductivity measurement has been carried out to ascertain the semiconducting nature of the copolymer resin. The electrical conductivity of the copolymer has been found to be 2.05×10^{-10} to $1.15 \times 10^{-8} \text{ ohm}^{-1} \text{ cm}^{-1}$ in the temperature range 313-428 K. The activation energy of electrical conduction has been found to be $6.48 \times 10^{-20} \text{ J/K}$. The plots of $\log \sigma$ Vs $10^3/T$ are found to be linear over a wide range of temperature, which obeyed the Wilson's exponential law $\sigma = \sigma_0 \exp(-\Delta E/KT)$ and the copolymer can be ranked as semiconductor.

Keywords: Copolymer, Synthesis, Characterization, Morphology, Electrical Conductivity

1. INTRODUCTION

The synthesized copolymer resins with highly conjugated chains have attracted much attention of scientist and introduce the recent innovations in the polymer chemistry in the last few years. The polymer scientists are trying to improve the properties of polymeric resins such as thermal stability, high chemical resistivity, durability, conductivity in the domain of desired applicability. Semiconducting polymers have been the subject of study for day to day application in modern electronics including gas sensors, telephones, radios, computers, antistatic coating, corrosion protection, in biosensors for coupling of electron transfer and many other electronic devices include transistors, solar cells, the silicon controlled rectifier, light-emitting diodes, and digital and analog integrated circuits [1-4]. Gupta has studied the electrical conductance behaviour of terpolymer resin-II derived from p-hydroxybenzaldehyde, urea and ethylene glycol [5]. Gabal et al. have reported the synthesis, characterization and electrical conductivity of polyaniline-Mn_{0.8}Zn_{0.2}Fe₂O₄ nano-composites [6]. Chinchamalapur and coworker have reported the electrical conductivity of some copolymers and its polychelates [7]. Electrical conductivity study of thermally stable newly synthesized terpolymer has reported by Niley and coworker [8]. Thakre [9] has synthesized the resins of 4-hydroxybenzoic acid, adipamide and formaldehyde and also studied the electrical conductance properties. Khedkar et al. [10] have studied the electrical conducting behaviour of newly synthesized m-cresol-hexamine-formaldehyde terpolymeric resin and its polychelates. Electrical conductivity measurement of salicylic acid-hexamethylenediamine-formaldehyde resin has studied by Masram et al. [11]. The present investigation deals with study of electrical conductivity of 2,4-dihydroxypropiophenone, 1,5-diaminonaphthalene with formaldehyde copolymer which has not been reported so far in literature.