

Evaluation the Electrical Conductivity of PEDOT: PSS as a Function of an Electrode Metal Type Under the Impact of a Neodymium Magnet

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ABSTRACT: The Poly (3,4-ethylene dioxythiophene): polystyrene sulfonate (PEDOT:PSS) thin films were coated after dilution with a distilled water, then applying it on different metal substrates by the casting method. An annular neodymium magnet (with 5 cm in diameter and 70 milli Tesla) was used in this study. All substrates are positioned in the center of a magnet during the coating processes. The intrinsic electrical conductivity of this semiconductor polymer is $9 \times 10^{-4} \text{ S.cm}^{-1}$. We used a range of substrates to cast several thin films onto various copper, aluminum, and ITO electrodes, each substrate dimensions are (2x2) centimeters.

The 25, 50, and 100 milliliters were taken since we used distilled water as a dilution solvent, the findings indicated that 50 milliliters of solvent were the optimal amount to apply to the aluminum electrode. As indicated earlier, one aspect of this effort is the use of many electrodes. Using varying amounts of solvent is the second dimension. The results explain the magnet affect the electrical conductivity of PEDOT:PSS up to $5 \times 10^{-2} \text{ S.cm}^{-1}$, after which the conductivity only increased by 100 times. The electrical conductivity of PEDOT:PSS is influenced by the type of electrode metal.

KEYWORDS: PEDOT:PSS, Conductivity, Electrical, Polymer, Electrode, and Magnet.

INTRODUCTION

Through the previous literature that has appeared since the discovery of the electrical properties of polyacetylene, a new type of materials has emerged known as conductive polymers, which is a special category that combines good mechanical properties, or rather a wide range of mechanical properties of varying degrees, with the electrical conductivity of metals, passing through the semiconductor characteristic. [1]

The improvement in electrical conductivity and mobility can be in one direction, thus making it a one-way conductor, we do not mean the absence of bilateral conductivity in the lateral direction, or triple conductivity in the lateral direction, or the direction of the chains of the polymer. Rather, the predominance here is in conductivity in the direction of the length of the polymer chain. [2]

Recently, a new way to improving of conductivity has emerged, there is a trend toward by applying a magnetic field to crystalline materials, or by monomers that polymerize to form oligomers and then form polymer chains with large molecular weights. The applying of a magnetic field effect on the movement of charge carriers within the polymer and causes a Lawrence force affecting charges movement. This application can lead to a change in the movement paths of the electric charge along the polymer chains or by jumping from one polymer chain to another, whether this chain is sideways,

above, or below, i.e., a transition to three-dimensional conductivity. Therefore, this improvement in electrical conductivity in a specific direction is known as anisotropy, resulting from the application of an external magnetic field to conductive polymers during the coating or the polymerization process. [3-5]

The process of applying a magnetic field to polymer chains, specifically during the coating process, which we have addressed in this research, in a new way that differs from other research or the literature on conductive polymers leads to a change in the directionality of polymer chains, as if they tend to elongate more and become unidirectional. To illustrate the idea, there was a paved road, but it was very twisted. The process of sweeping of the magnetic field along these twisted paved roads will reduce or eliminate these twists over a long distance, leading to the convergence of these paved roads, or rather, the polymer chains. This convergence reduces the energy gap between the polymer chains on the one hand and increases mobility and speed along the road, or rather along the polymer chain, and thus a general change in the crystalline properties of these polymers, which increases the percentage of crystallinity in the polymers. [6-10]

Therefore, this change in crystallinity necessarily leads to a change in the optical properties and directional light emission or selective light absorption of crystalline polymers under the influence of the magnetic field, which in turn affects the