



Full length article

Synthesis, morphological and optical characterizations of the poly (O-toluidine)-LiCl networks thin film

R.K. Fakher Alfahed^a, Ahmed S. Al-Asadi^b, Mohammed F. Al-Mudhaffer^b, Hussain A. Badran^{b,*}

^a Al-Nahrain Nano- Renewable Energy Research Center, Al-Nahrain University, Iraq

^b Department of Physics, College of Education for Pure Science, University of Basrah, Iraq

HIGHLIGHTS

- Poly (O-toluidine) thin films were synthesized using a chemical reaction method.
- The pattern analyses of XRD displays the amorphous nature of Polymer films.
- Thermal lens was demonstrated to determine the thermal optical coefficients.
- Enhancement factor and thermal figure of merit were also investigated.
- The obtained results can be employed in the application of optoelectronic devices.

ARTICLE INFO

Keywords:

LiCl
Poly (O-toluidine)
Networks
Surface morphology
Optical properties
Thermal lens

ABSTRACT

Networks containing poly (O-toluidine) (POT) and LiCl (5%, 10%, 20%, 30% V/V) were synthesized in thin films formed using a chemical reaction method. Details analysis of the surface morphology for the prepared thin films was conducted using scanning electron microscopy (SEM) along with the Image J software. It is clearly observed that the percentage rate of LiCl is highly influence on the morphology of the POT surfaces. The Fourier-transform infrared spectroscopy and X-ray diffraction patterns are utilized to confirm the corresponding chemical bonds and the crystalline structure of the fabricated networks, respectively. The energy gap of the POT thin films was calculated based on the UV-Vis measurements and the values exhibit a directly allowed transition. The room thermal optical coefficients of POT were evaluated through the thermal lens technique as a function of LiCl concentrations. The aforementioned findings suggest the high impacts of the fabricated networks in several applications related to optoelectronics and energy storage areas.

1. Introduction

Recently, substantial efforts have been focused on the elaboration of novel materials that could be applicable to fulfill the required physical and chemical properties for several applications [1–7]. Among many available materials, conducting polymers (CPs) have taken a huge interest of researchers and became the core of several devices due to their flexibility, electrical and thermal stability, low production cost, light-weight, solution processability and durability [8,9]. For instance, CPs are considered to be suitable in some applications related to the fabrication of electrodes for energy storage devices, organic light-emitting diode (OLED), optoelectronic devices, solar cells, Schottky diodes etc. [10–14]. However, offering additional systems based on CPs with unique characteristics and better properties are still needed [15,16]. Therefore, matrices based on the CPs can be developed through the

creation of composites [17], blends [18], and even interpenetrating polymer networks (IPNs) [19,20]. Among the many aforementioned matrices, the networks of CPs/ Li salt harvest coincident enhancements in their essential performance.

Polyaniline (PANI) and its derivatives have optical fibula and electrochemical properties as well as high environmental stability with less complexity in the synthesizing process [21,22]. One of polyaniline derivative is a poly (O-Toluidine) (POT), which possess $-\text{CH}_3$ group in the aromatic ring [23]. In particular, POT has received a lot of attention as an interesting material for several applications, such as electrochromic and electronic devices [24–27]. The influences of various dopants were studied to enhance the electrical, optical, and electronic properties of conducting polymeric materials [28–30]. Especially, the Li salts were used as attracted dopants by many authors. Dominic et al. [31] and his colleagues synthesized the polyaniline doped by LiCl as co-

* Corresponding author.

E-mail address: badran_hussein@yahoo.com (H.A. Badran).

<https://doi.org/10.1016/j.optlastec.2020.106524>

Received 10 September 2019; Received in revised form 28 July 2020; Accepted 1 August 2020

0030-3992/ © 2020 Elsevier Ltd. All rights reserved.