Journal of Materials Science: Materials in Electronics
https://doi.org/10.1007/s10854-018-9448-7

Enhancement in the dielectrics of poly(*o*-toluidine)/single wall carbon nanotubes (POT/SWCNTS) polymer nanocomposites for electrical energy storage

Shama Islam[1] · Shabir Ahmad[1] · Hana Khan[1] · M. Zulfequar[1]

Received: 29 March 2018 / Accepted: 8 June 2018

Abstract
Present study focuses on influence of carbon nanotubes in POT polymer, in order to improve performance of energy storage devices. (POT/SWCNTS) nanocomposites are synthesized by situ polymerization with different concentrations of SWCNTS. POT had long chain of qunoid and benzoined rings provide together large transport of charge along with SWNTs resulting to store large amount of electric charge. Synthesized samples are characterized by dc conductivity; UV–Vis studies, FTIR, X-ray diffraction (XRD) and dielectric techniques. Electrical conductivity enhances up to four orders with dopant concentrations. Incorporation of dopant into polymer matrix is confirmed by FTIR studies. XRD analysis revealed crystallinity of nanocomposites. Present consequences of synthesized polymer nanocomposites shows meaningful impact with changes in dielectric properties due to better dispersion of SWCNTS in polymer matrix. As results enhancements in dielectric parameters values, highlights their great potential for supercapacitors. These nanocomposites do not need any binding substance that is an important practical advantage.

1 Introduction

The number of researchers has attracted the interest in polymer nanoparticle composite materials in recent years, due to their excellent and amalgam properties resulting from numerous mechanisms. These materials put forward unique properties in terms of mechanical electrical optical and thermal, whether taken into solution or in bulk form [1–4]. The enhancements in the properties of these materials resulting from the interaction between the polymer and nanoparticles and also on state of dispersion [5]. Recently, rewards of nanoparticles are being ever more investigated due to loading necessities are moderately low as compared to conventional additives [6]. The motivation of present research on nanostructures is significantly driven by the necessity for minimizing features. In the regime of nanomaterials, carbon nanotubes with polymers have gained enormous attention because of their extensive potential applications electronics [7–9], biological and chemical sensing [10], and optical applications [11]. Polymer nanocomposites are of supreme importance in various fields of research, because polymers can be exploited in various ways as a consequence of variation in their properties, like magnetic, optical and structural properties over metal and semiconductor. POT is oftenly considered supreme over poly(aniline) because of its ease in processability, as a result of better dissolution properties of POT in solvents in comparison to polyaniline, also because of good thermal and ecological firmness POT is found to be preferred over polyaniline [12]. Many researchers have already designed Schottkey diodes with POT/metal contact. Profitable inquisitiveness in carbon nanotube polymer nanocomposites chiefly due to their conductivity at very low loading levels. Motivated in part by developed importance and concerns above rational property, primary precise studies be plentiful in the literature. The optical properties of conducting polymer (CP) nanocomposites purposefully ascertain their sensible applications in electro optics, as have hardly ever been reported since of their elevated absorption to electromagnetic waves and so tiny to be measured by traditional method [13]. Single-walled carbon nanotubes (SWCNTS) are one dimensional (1D) tubular material with sp^2 bonded graphene wall. Their exclusive geometry gives climb to spiky divergences in electronic solidity of states and accordingly leads to distinguishing distinct energy subbands.

✉ M. Zulfequar
mzulfe@rediffmail.com

[1] Department of Physics, Jamia Millia Islamia, New Delhi 110025, India

Published online: 11 June 2018