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Electrochemical Behavior of Conductive Cotton Textile: Effect of Conducting Particles

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ABSTRACT

In this study, a electrochemical sensor based on smart textile was fabricated. The smart conductive textiles was prepared using coating of a cotton fabric by different four conductive particles include single and multi-wall carbon nanotube, graphene oxide and silver nanoparticles and their conductivity properties was compared together. The scanning electron microscope was used to observation of surface morphology of the fabric samples. The coated fabric by silver nanoparticles has highest conductivity in compared with carbon coated fabrics. The performance of Ag coated fabric was evaluated as a working electrode.

Keywords: Screen-printed electrodes, Fabrics, Textile, Ag nanoparticles.

1. INTRODUCTION

Electrically conductive textiles have been of increasing research interest due to potential application in clothing as well as in the medical and military fields, as sensors, actuators, electromagnetic shields etc [1].

Sensors provide a nervous system to detect signals, thus in a passive smart material, the existence of sensors is essential. Textile-based sensing has been a large field of research in the biomedical and safety communities [2]. These sensors can be used for electrocardiogram [3], flexible solar cell panels [4], protective garments for electromagnetic shielding and static charge dissipation [5], heating elements [6], fabrics for dust and germ-free clothes [7], pressure sensors [8], chemical sensors [9], power sources [10], and wireless devices [11].

Conductive textiles by incorporating CNT through a coating or dyeing process are already studied by many authors [12]. The excellent mechanical, electrical, and thermal properties of CNT and their high aspect ratios make them one of the most interesting nanoparticles in the technology world today. There are many different types of CNT, but they are normally classified as either single-wall (SWNTs) or multi-wall nanotubes (MWNTs), which have lengths of ~10 μm. On the other hand, in literatures was observed that metal nanoparticles was deposited on fabrics for preparation of conductive textiles using in situ synthesis or Inkjet printing methods [13, 14].

Recently, Govaert and Vanneste (2014) were developed the electrical conductivity textile by coating of CNT using direct coating, transfer coating, and screen printing methods [14]. The electrically-conducting MWCNT networks was formed on cellulose mono- and multi-filament fiber surfaces by Qi and co wrokers [15]. Nafeie et al, fabricated conductive wool fabrics multiwall carbon nanotube and carboxylated multiwall carbon nanotube (FMWCNT). They said that samples treated with FMWCNT exhibited conductivity 10 times higher than MWCNT, because there is interactions between the functional groups of wool and carboxyl groups of FMWCNT [16]. Sarkar et al have been used from macro-structured carbon clusters for develop of conductive cotton fabric. Their results showed that lowest resistivity level achieved by this process is less than 60 ± 5.4 Ohm/cm2. Karimi et al were reported a novel and efficient process for fabrication of multifunctional cellulose textiles using a graphene/titanium dioxide nanocomposite [17]. In other study, Flexible conductive circuits on PET fabrics with screen printing were fabricated by wang et al [18]. Moazami et al (2016) were introduced a smart textile with tunable properties by chemical modification of polyester fabric using reduced graphene oxide/silver nanocomposites. The electrical resistivity of raw and modified polyester samples was varied due to the diverse formation of the graphene nanosheets network on the fabric surface[19]. Cui et al (2015) have used the combination silver nanowires and