UNIVERSITI TEKNOLOGI MARA

CONDUCTIVITY MEASUREMENT OF NANOSTRUCTURED FILM OF PAA-PAN-GOLD NANOPARTICLES

NUR SYAFIKA BINTI ABDUL RAZIFF

Bachelor of Engineering (Hons) Chemical

Faculty of Chemical Engineering

July 2019

ABSTRACT

The effect of humidity on electrospun fibre morphology and conductivity on gold nanoparticles loading were investigated in the study. Electrospinning technique was introduced. Polymer blend of polyacrylic acid (PAA) and polyacrylonitrile (PAN) solutions were prepared and used to form electrospun fibre. Mixture of PAA/PAN solution was then prepared to be used as precursor for the electrospinning. The distance from the tip of the needle to the aluminium foil plate for electrospinning, voltage, temperature and feed rate were kept constant. The humidity of the process was the only parameter that was varied at 30%, 40%, 50% and 60% relative humidity (RH). After the electrospinning process, the characterization analysis was done using SEM analysis and EIS analysis. SEM analysis was done with the sample without gold nanoparticles (AuNPs) loading for each relative humidity and only the sample with the highest conductivity measured which was at 30 % RH, was added with 0.1 ml of AuNPs to study the morphology of the electrospun fibre. For EIS analysis, two part of conductivity measurement were done. The first part was without the addition of AuNPs and the second part was with the addition of 0.1 ml of AuNPs to the electrospun fibre. It showed that different humidity had different morphology and different fibre size distribution. The average fibre diameter was the lowest at 30% RH and the highest at 60% RH. Average fibre diameter increased as relative humidity increased and the fibre size distribution also increased as the relative humidity increased. Conductivity measured was the highest at 30% RH and the lowest conductivity measured was at 60% RH. Value of conductivity measured of the electrospun fibre was higher with the addition of AuNPs compared to the electrospun fibre without AuNPs. Nanoparticles was an ideal material used to enhance conductivity of electrospun fibre to be used in sensor applications.

TABLE OF CONTENT

CHAPTER THREE: RESEARCH METHODOLOGY

CHAPTER FOUR: RESULTS AND DISCUSSION

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

CHAPTER 1

INTRODUCTION

1.1 Research Background

Sensor fabrication technology is currently receiving a great interest among the researchers and the interest is expected to grow in the future. Sensor is basically an electronic device which can detect and record physical characteristic. Then it will respond towards it accordingly, as well as determine the level of detection (Husain et al., 2018). In other words, a sensor receives an input signal, then it will process the signal and finally translate a proper output signal. This is to ensure that the signal can be read properly by the observer.

There are various types of sensors such as chemical sensors and biological sensors. The sensors can be classified referring to the analyte, for instance, solid, liquid and gas. But these can be also further categorized as optical, electrochemical or thermometric sensors. These sensors are designed and then fabricated based on their purposes and applications based on the view of the research community. But majority of the sensors available in the market today operates at high temperature with poor sensitivity, selectivity and stability (Husain et al., 2018). In contrast, sensor needs to be highly sensitive, quick response as well as recovery and low power usage to be consider as efficient and cost effective (Kumar et al., 2018).

Polymers involving nanotechnology are being used in sensor technology to improve the sensor's performances. This is because the chemical and physical properties of polymers can be alter based on various range of characteristics. By replacing classical sensor materials with polymers and nanotechnology, a better selectivity and rapid measurements have been achieved. The functions of polymers used in sensor devices are either they involve in the sensing mechanisms or they immobilize the components which responsible to detect the analyte (Adhikari & Majumdar, 2004). As for this research, the polymers that are being used are polyacrylic acid (PAA) and polyacrylonitrile (PAN).

Besides that, nanoparticles also another material used that are able to enhance sensor performances. Significant properties of nanomaterials such as high surface area to volume ratio, improved chemical and optical properties have bring the sensor technology to another