CHAPTER II

HYPOTHESIS & RESEARCH PROBLEMS

2.1 Research Objectives

The objective of this research work was to prepare the organic light emitting diode substrate from cellulose nanocomposite. This nanocomposite allowed us to obtain the excellent substrate with additional features of flexibility and transparency. Generally, in order to conduct this research work, cellulose was successfully extracted from Nata de Coco product and it was subsequently fabricated as nanocomposite with polyurethane based resin for mechanical properties enhancement and water absorption reduction. Prior to prepare OLED circuit, nanocomposite was investigated for thermal, mechanical and optical properties. After that, ferrofluid solution was synthesized to use as nano-abrasive particle in order to reduce the surface roughness and Si-O layer was consequently deposited by plasma enhance chemical vapor deposition for moisture absorption prevention to cellulose.

After that, OLED circuit was prepared on nanocomposite by means of two different techniques which referred to dry technique and wet technique. In this work, organic vapor phase deposition is referred to dry technique, while, desktop inkjet printer is also referred to wet technique. The relevant conductive polymers were synthesized and subsequently fabricated as electrode and emissive layer in OLED circuit.

2.2 Hypothesis

The hypothesis of this research can be prepared as following procedure;

2.2.1 Substrate Preparation

- To extract and modify bacterial cellulose from Nata de Coco for flexible thin substrate of organic light emitting diode (OLEDs) device.

- To prepare bacterial cellulose reinforced with polyurethane based resin as a nanocomposite with minimum requirement properties of OLED substrate.

1. Light transmittance is higher than 85%
2. Refractive index need to be ~ 1.5
3. Glass transition temperature is ~ room temperature
4. Surface roughness need to be less than 5 nm.
5. Water absorption need to be less than 10^{-6} g/m^2/day
6. Oxygen permeation test need to be less than 10^{-3} ml/m^2/day)
7. Coefficient of thermal expansion need to be less than 20 ppm/K
8. Flexibility

- To reduce the surface roughness of composite by means of using ferrofluid solution

- To develop the super thin glass on nanocomposite for being thin barrier layer propose in order to reduce water absorption to cellulose

2.2.2 Organic Light Emitting Diode (OLED) Circuit

- Dry technique

To use organic vapor phase deposition for OLED fabrication

- Wet technique

To use desktop inkjet printer for OLED fabrication

1. To prepare PEDOT: PSS as anode of OLEDs
2. To synthesize silver nanoparticle as cathode of OLEDs
3 To synthesize ZnS and metal-doped ZnS nanoparticle as emissive layer of OLEDs
4 To prepare hybrid nanocomposite ZnS and PVP for emissive layer of OLEDs properties enhancement