CHAPTER 5 CONCLUSION AND SUGGESTIONS FOR FURTHER WORK

Copper(II) cinnamate can be easily prepared from copper(II) acetate and cinnamic acid. The reaction gave cis- and trans- isomers in almost equal amount.

The conductivity of copper(II) cinnamate at room temperature was 5.22×10^{-11} Scm^{-1}. It showed metallic behaviour in the temperature range 86 – 285K, and its conduction mechanism followed Mott's variable range hopping model with the following parameters: T_o, 1531K; $N(E_F)$, 6.35×10^{23} $eV^{-1}cm^{-3}$; R (298 K), 3.38 Å; ΔE (298 K), 0.0097 eV; and n (298 K), 1.63×10^{28} cm^{-3}.

Copper(II) cinnamate, doped with 4 – 20% iodine, showed conductivity at room temperature in the range of $(0.13 - 48.2) \times 10^{-10}$ Scm^{-1}, with highest conductivity for sample doped with 16.0% iodine. Iodine, at 4 – 20% concentrations, was found to have no significant effect on the structure of copper(II) cinnamate.

Copper(II) cinnamate doped with 16.0% iodine showed metallic behaviour in the temperature range 78 – 300K, and its conduction mechanism followed Mott's variable range hopping model with the following parameters: T_o, 969K; $N(E_F)$, 1.00×10^{24} $eV^{-1}cm^{-3}$; R (298 K), 3.02 Å; ΔE (298 K), 0.0087 eV; and n (298 K), 2.5×10^{28} cm^{-3}.

The structure of copper(II) cinnamate was little affected on annealing at 50°C to 150°C. The highest conductivity value of 1.18×10^{-9} Scm^{-1} was for sample annealed at 150°C.

Similarly, the structure of copper(II) cinnamate doped with 16.0% iodine was little affected on annealing at 50°C to 150°C. The highest conductivity value of 6.03×10^{-9} Scm^{-1} was for sample annealed at 150°C.

Further work that may be suggested to ascertain the structure of copper(II) cinnamate include Scanning Electron Microscopy (SEM) and X-Ray Diffraction (XRD). It is also useful to know the thermal properties of copper(II) cinnamate by means of Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC). The conductivity of copper(II) cinnamate as thin film and the effect of other dopants such as iron(III) chloride may also be done.

APPENDIX I

Error Analysis

The following method was used to calculate the error of thickness, radius and area of electrode, and conductivity.

(a) Thickness of sample, T

$$\overline{T} = \frac{\sum_{1}^{N} T}{N}$$

$$\sigma^2 = \frac{\sum_{1}^{N} (T - \overline{T})^2}{N}$$

$$\Delta T = \frac{\sigma}{N}$$

where N is the number of measurement taken and T is the sample thickness

(b) Diameter of electrode, D

The radius of electrode is given by

$$R = \frac{D}{2}$$

and the error of diameter is given by

$$\Delta D = \left(\frac{\Delta R}{R}\right) D$$

where D is the diameter of electrode and R is the radius of electrode

(c) Area of Electrode

The area of electrode is given by

$$A = \pi R^2$$

and the error of electrode area is given by

$$\Delta A = 2A\frac{\Delta R}{R}$$

(d) Conductivity

The conductivity, σ is given by

$$\sigma = \frac{I\overline{T}}{VA}$$

$$\sigma = \frac{4m\overline{T}}{\pi\overline{D}^2}$$

$$\Delta\sigma = \sigma\left[\left(\frac{\Delta m}{m}\right)^2 + \left(\frac{\Delta\overline{T}}{\overline{T}}\right)^2 + 2\left(\frac{\Delta\overline{D}}{\overline{D}}\right)^2\right]^{\frac{1}{2}}$$