CHAPTER 10

SUMMARY

PbPc thin films were prepared by thermal evaporation technique and presented in this thesis. The salient features associated with characterization of these thin films are summarized in this chapter. Details of the experimental results are discussed as follows.

i. PbPc thin films of thickness 150 nm, 300 nm and 450 nm on glass substrate and 150 nm on KCl substrate were prepared by thermal evaporation technique. The higher thickness 450 nm on glass film is annealed in air at 323 K and 373 K.

ii. XRD analysis confirmed that thermally evaporated PbPc films at room temperature are of monoclinic nature at lower thickness and a mixture of monoclinic and triclinic nature at higher thicknesses. When annealing is carried out, triclinic phase becomes predominant.

iii. EDAX analysis was used to find the elemental composition. The composition of the films deposited at higher thickness and annealed temperatures have more percentage.

iv. FT-IR analysis identifies the spectral pattern in this region, which are depends strongly on the molecular structure of the complexes and its chemical structure for the central metal.
v. The SEM analysis shows that with increasing thickness, rod-like structures with fine particles are seen and with increasing annealed temperature, the surface becomes smooth and uniform. The particle size of fine crystals formed on the glass substrate is smaller than that on the KCl substrate.

vi. The AFM analysis helps to study grain size and surface of the films. The annealed AFM image indicates a smooth surface. The roughness also decreases with increase in film annealing temperature.

vii. Optical studies of PbPc films shows the existence of two absorption bands at low energies less than 2.4 eV and high energies greater than 2.4 eV. The spectrums reveal that both the absorbance and extinction coefficient increases with increase in annealed temperatures. The band gap decreases with the increase in film thickness.

viii. PL spectra consist of 5 bands for the excitation energy of 2.4 eV whereas the spectrum has 6 bands for the pump power has been increased to 3.3 eV. Stoke’s shift has been found that the absorption peaks occur at wavelength 350 and 710 nm and emission peak is found at 764 and 822 nm.

ix. The conductivity of PbPc on the glass substrate is around 20 times larger than KCl substrate. The larger difference in the electrical property between the PbPc on glass and KCl substrate is caused by the orientation of the molecular planes in the film.

x. The dielectric constant increases with increase in temperature at all frequencies and this parameter is related to the
conductivity of the films because the conductivity increases as the temperature increases. The conductivity is strongly frequency dependent. The conductivity increases with increasing frequency.

xi. In Current-Voltage characteristics, the current increases with increase in the thickness of the film. As the voltage is increased, the number of injected carriers increases, so that space charge accumulates limiting the current. The thermionic emission behaviour is observed at higher temperatures.