CONTENTS

PREFACE i
LIST OF TABLES viii
LIST OF FIGURES xii

CHAPTER 1
BRIEF REVIEW OF THE STUDIES IN PHTHALOCYANINES

1.1 Introduction 2
1.2 Organic semi conductors 3
1.3 Phthalocyanines 9
1.4 Molecular structure of phthalocyanines 10
1.5 Electrical studies 17
1.6 Effect of doping on the electrical properties of phthalocyanines 22
1.7 Fabrication of phthalocyanine thin film device 25

References 30

CHAPTER 2
APPARATUS AND EXPERIMENTAL TECHNIQUES

2.1 Introduction 43
2.2 Methods of preparation of thin films 44
2.3 Thermal evaporation technique 45
2.4 Effect of substrate surface 46
2.5 Effect of residual gases 47
2.6 Effect of evaporation rate 47
CHAPTER 3
ELECTRICAL PROPERTIES OF FePc, MgPc and NiPc
THIN FILM DEVICE

3.1 Introduction 74
3.2 Theory 76
3.3 Experiment 82
3.4 Results and Discussion 83
   3.4.1 Dependence on film thickness 83
   3.4.2 Dependence on air annealing 89
   3.4.3 Dependence on substrate temperature 94
   3.4.4 Hopping conduction 99
3.5 Conclusion 104
References 105
CHAPTER 4
STUDIES ON DESIGN, FABRICATION AND CHARACTERISTICS OF SCHOTTKY DIODES USING FePc, MgPc and NiPc –PART I

4.1 Introduction
4.2 Theory
   4.2.1 Theory of Metal Semiconductor contacts
   4.2.2 Theory of Current transport mechanism
4.3 Experiment
4.4 Results and Discussion
   4.4.1 Electrical characteristics of Al/FePc/Al device
   4.4.2 Electrical characteristics of Al/MgPc/Al device
   4.4.3 Electrical characteristics of Al/NiPc/Al device
   4.4.4 Electrical characteristics of Au/FePc/Au device
   4.4.5 Electrical characteristics of Au/MgPc/Au device
   4.4.6 Electrical characteristics of Au/NiPc/Au device
4.5 Conclusion
References

CHAPTER 5
STUDIES ON DESIGN, FABRICATION AND CHARACTERISTICS OF SCHOTTKY DIODES USING FePc, MgPc and NiPc –PART II

5.1 Introduction
5.2 Theory
5.3 Experiment
5.4 Results and Discussion
   5.4.1 Electrical characteristics of Au/FePc/Al Schottky device
   5.4.2 Electrical characteristics of Au/FePc/Pb Schottky device
   5.4.3 Electrical characteristics of Au/MgPc/Al Schottky device
### CHAPTER 6
**EFFECT OF DOPING ON THE DEVICE CHARACTERISTICS OF SCHOTTKY DIODES FABRICATED USING FePc, MgPc & NiPc**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Introduction</td>
<td>205</td>
</tr>
<tr>
<td>6.2</td>
<td>Theory</td>
<td>206</td>
</tr>
<tr>
<td>6.3</td>
<td>Experiment</td>
<td>208</td>
</tr>
<tr>
<td>6.4</td>
<td>Results and Discussion</td>
<td>210</td>
</tr>
<tr>
<td>6.4.1</td>
<td>Electrical characteristics of Iodine doped Au/FePc/Al device</td>
<td>210</td>
</tr>
<tr>
<td>6.4.2</td>
<td>Electrical characteristics of Iodine doped Au/MgPc/Al device</td>
<td>214</td>
</tr>
<tr>
<td>6.4.3</td>
<td>Electrical characteristics of Iodine doped Au/NiPc/Al device</td>
<td>218</td>
</tr>
<tr>
<td>6.4.4</td>
<td>Electrical characteristics of Au/Mixed Pc/Pb device</td>
<td>223</td>
</tr>
<tr>
<td>6.5</td>
<td>Conclusion</td>
<td>229</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>230</td>
</tr>
</tbody>
</table>

### CHAPTER 7
**SUMMARY AND CONCLUSION**

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>234</td>
</tr>
</tbody>
</table>