

**ELECTRICAL PROPERTIES OF MACROMOLECULES :  
STUDIES ON  
SOME THIOUREA AND PHTHALOCYANINE SYSTEMS**

**THESIS**  
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IN FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE  
OF  
DOCTOR OF PHILOSOPHY  
IN  
CHEMISTRY

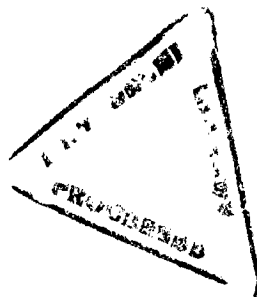
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**JULY, 1982**

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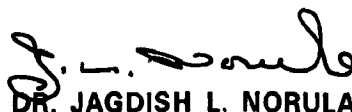
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# CERTIFICATE

This is to certify that the thesis entitled "ELECTRICAL PROPERTIES OF MACROMOLECULES : STUDIES ON SOME THIOUREA AND PHTHALOCYANINE SYSTEMS", being submitted by Mr. HARI SINGH NALWA for the award of the degree of DOCTOR OF PHILOSOPHY in CHEMISTRY of the INDIAN INSTITUTE OF TECHNOLOGY, DELHI, is a record of bonafide research work carried out by him under our guidance and supervision. To our knowledge, it has reached the standard of fulfilling the requirements of the degree. The matter embodied in this thesis has not been submitted for the award of any degree or diploma of any other University or Institute.



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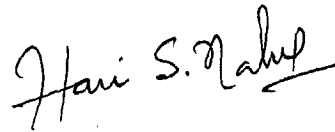
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## ABSTRACT

The present thesis deals with the electrical properties of organic macromolecules. Two types of polymeric systems containing thiourea and phthalocyanine as monomer units respectively were chosen for study. Thiourea was condensed with formaldehyde to prepare thiourea-formaldehyde condensates in acidic ( $\text{CH}_3\text{COOH}$ ) as well as in basic ( $\text{NaOH}$ ) medium. Metallophthalocyanines of iron, cobalt, nickel and copper as well as polymeric metallophthalocyanines of iron and copper were synthesized.

These samples were characterized by elemental analysis, infrared spectroscopy, Mossbauer spectroscopy and X-ray diffraction technique etc. Thermal behaviour was studied by thermogravimetric analysis, derivative thermogravimetry, differential scanning calorimetry and differential thermal analysis.

The various electrical properties such as resistivity, dielectric constant and loss, thermally stimulated depolarization effect and pyroelectric effect were studied on these materials as a function of temperature. Attempt has also been made to establish a correlation between the electrical properties and the chemical structures.

Both thiourea-condensates and metallophthalocyanine systems show interesting electrical properties. Very high values of dielectric constants were observed in these systems possibly due to nonadmic polarization. TUF condensates synthesized in the basic medium and metallophthalocyanines of iron, cobalt and copper as well as polymeric metallophthalocyanines of iron and copper exhibit pyroelectric effect.

## CONTENTS

	<u>Page No.</u>
CHAPTER 1 INTRODUCTION	1
1,1 Classification of Organic Compounds	2
1.1.1 Monomers	4
1.1.1.1 Aromatic Hydrocarbons	4
1.1.1.2 Organic Dyes	7
1.1.1.3 Organometallic Compounds	7
1.1.1.4 Radicals	8
1.1.1.5 Donor-Acceptor Complexes	8
1.1.2 Polymers	
1.1.2.1 Polymers with Saturated Main Chain	9
1.1.2.2 Conjugated Polymers	10
1.1.2.3 Organometallic Polymers	12
1.1.2.4 Charge-Transfer Polymers	14
1.1.2.5 Biopolymers	16
1.2 Electrical Properties	17
1.2.1 Semiconductance	17
1.2.1.1 Electronic Conduction	19
1.2.1.2 Ionic Conduction	20
1.2.1.3 Semiconductivity and Chemical Structure	21
1.2.1.4 Applications of Organic Semiconductors	23
1.2.2 Dielectric Properties	24
1.2.2.1 Dielectrics	24
1.2.2.2 Theory of Dielectrics	27
1.2.2.3 Dielectric Constant- Polarization and Chemical Structure	32
1.2.2.4 Applications of Dielectrics	40

	<u>Page No.</u>
1.2.3 Electrets	42
1.2.3.1 Thermally Stimulated Depolarization Effect (TSD)	43
1.2.3.2 Theory of TSD Effect	46
1.2.3.3 Applications of Electrets	49
1.2.4 Pyroelectricity	50
1.2.4.1 Pyroelectric Materials	52
1.2.4.2 Pyroelectric Coefficient	54
1.2.4.3 Spontaneous Polarization	56
1.2.4.4 Pyroelectricity and Crystal Structure	59
1.2.4.5 Ferroelectricity	62
1.2.4.6 Piezoelectricity	62
1.2.4.7 Correlation Between Pyro-, Piezo- and Ferroelectrics	63
1.2.4.8 Applications of Pyroelect- rics	63
1.3 Scope of the Present Work	64
1.3.1 Thiourea-formaldehyde Condensates	65
1.3.2 Metallophthalocyanines	66
1.3.3 Scope of the Work	67
1.3.3.1 Phase I Synthesis	67
1.3.3.2 Phase II Characterization	67
1.3.3.3 Phase III Study on Electrical Properties	67
CHAPTER 2 EXPERIMENTAL TECHNIQUES	69
2.1 Characterization of Samples	69
2.1.1 Elemental Analysis	69
2.1.2 Infrared Spectroscopy	69
2.1.3 Thermal Methods of Analysis	70
2.1.4 X-ray Diffraction Studies	70
2.1.5 Mossbauer Spectroscopy	71

2.2	Electrical Properties	71
2.2.1	Resistance	71
2.2.2	Dielectric Measurements	73
2.2.3	Thermally Stimulated Depolarization Studies	75
2.2.4	Pyroelectric Measurements	76
CHAPTER 3	THIOUREA-FORMALDEHYDE CONDENSATES	78
3.1	Amino Resins	78
3.2	Chemistry of Amino-resins	78
3.3	Experimental Techniques	82
3.3.1	Synthesis of Samples	82
3.3.2	Characterization	83
3.3.3	Electrical Measurements	84
3.4	Results and Discussion	86
(A)	TUFA <sub>2</sub> Condensates	86
3.4.1	Characterization	86
3.4.1.1	Elemental Analysis	86
3.4.1.2	Infrared Spectroscopy	86
3.4.2	Electrical Properties	90
3.4.2.1	Resistivity	90
3.4.2.2	Dielectric Constant and Loss	92
3.4.2.3	Thermally Stimulated Depolarization Effect	92
3.4.2.4	Pyroelectric Effect	112
(B)	TUFB Condensates	113
3.5.1	Characterization	113
3.5.1.1	Elemental Analysis	113
3.5.1.2	Infrared Spectroscopy	115
3.5.1.3	Thermal Methods of Analysis	118
3.5.2	Electrical Properties	119
3.5.2.1	Resistivity	119
3.5.2.2	Dielectric Constant and Loss	119
3.5.2.3	Thermally Stimulated Depolarization Effect	120

	<u>Page No.</u>
CHAPTER 4 METALLOPHTHALOCYANINES	143
4.1 Introduction	143
4.2 Synthesis of Metallophthalocyanines	145
4.2.1 Synthesis of Monomeric Metallophthalocyanines	145
4.2.2 Synthesis of Polymeric Metallophthalocyanines	147
4.3 Mechanism for the Formation of Phthalocyanine Macrocycle	147
4.4 Structure of Metallophthalocyanines	150
4.4.1 Structure of Monomeric Metallophthalocyanines	150
4.4.2 Structure of Polymeric Metallophthalocyanines	152
4.5 Electrical Properties of Metallophthalocyanines	153
4.6 Experimental Techniques	154
4.6.1 Synthesis of Samples	154
4.6.2 Characterization	159
4.6.3 Electrical Measurements	161
4.7 Results and Discussion	162
(A) Monomeric Metallophthalocyanines	162
4.7.1 Characterization	162
4.7.1.1 Elemental Analysis	162
4.7.1.2 Infrared Spectroscopy	163
4.7.1.3 Mossbauer Spectroscopy	171
4.7.1.4 X-ray Diffraction Technique	173
4.7.1.5 Thermal Methods of Analysis	177
4.7.2 Electrical Properties	178
4.7.2.1 Resistivity	178
4.7.2.2 Dielectric Constant and Loss	183
4.7.2.3 Thermally Stimulated Depolarization Effect	189
4.7.2.4 Pyroelectric Effect	191

(B) Polymeric Metallophthalocyanines	196
4.8.1 Characterization	196
4.8.1.1 Elemental Analysis	196
4.8.1.2 Infrared Spectroscopy	203
4.8.1.3 Mossbauer Spectroscopy	208
4.8.1.4 X-ray Diffraction Technique	209
4.8.1.5 Thermal Methods of Analysis	211
4.8.2 Electrical Properties	212
4.8.2.1 Resistivity	212
4.8.2.2 Dielectric Constant and Loss	216
4.8.2.3 Thermally Stimulated Depolarization Effect	222
4.8.2.4 Pyroelectric Effect	224
 CHAPTER 5 SUMMARY AND CONCLUSIONS	 228
5.1 Summary	228
5.2 Conclusions	235
5.3 Scope for Future Work	236

## REFERENCES

## LIST OF PUBLICATIONS

## BIO-DATA