

C O N T E N T S

	Page
CHAPTER I	1
REVIEW OF ELECTRICAL CONDUCTION AND OPTICAL STUDIES IN ELECTROCHROMIC AND PHOTOCROMIC THIN FILMS	
1.1. Introduction	2
1.2. Earlier work	6
1.3. Electrochromism	12
1.4. Photochromism	15
1.5. Thermochromism	17
1.6. Electrochromic devices	17
1.7. Energy band structure	22
1.8. DC conduction mechanism in Metal-Insulator-Metal (MIM) films.	24
1.8.1. High field conduction	25
1.8.2. Low field conduction	28



1.8.3.	Temperature dependence	33
	References	35
	CHAPTER II	43
	APPARATUS AND EXPERIMENTAL TECHNIQUES USED IN THE PRESENT STUDY	
2.1	Introduction	44
2.2	Methods of preparation	44
2.2.1	Resistive heating evaporation	46
2.2.2	Electron beam evaporation	47
2.3	Production of vacuum	50
2.3.1	Oil-sealed rotary pump	51
2.3.2	Diffusion pump	52
2.4	Vacuum coating plant	54
2.5	Substrate cleaning	56
2.6	Preparation of films	57
2.7	Preparation of MIM structure films.	58
2.8	Measurement of the thickness of films	59



2.8.1	Optical Method (Multiple beam interferometry)	59
2.8.2	Quartz crystal thickness monitor	63
2.9	Measurement of electrical characteristics.	66
2.9.1	Conductivity measurements	66
2.9.2	Conductivity cell	68
2.9.3	Electrometer	70
2.9.4	Capacitance measurements	71
2.10	Measurement of optical characteristics	72
2.10.1	UV-visible spectrophotometer	72
2.10.2	Infrared spectrophotometer	74
2.10.3	X-ray diffractometer	75
2.10.4	Optical microscopy	76
2.11	Measurement of thermal characteristics	77
2.11.1	Thermogravimetry - D T A	77
2.11.2	Thermo-emf measurement	78
	References	80



CHAPTER III	82
ELECTRICAL STUDIES IN MOLYBDENUM TRIOXIDE, VANADIUM PENTOXIDE, AND TITANIUM DIOXIDE FILMS.	
3.1 Introduction	83
3.2 Experiment	87
3.4 Results and discussion	88
3.3.1 DC electrical conductivity in coplanar geometry	88
(σ_{\parallel})	
3.3.2 DC electrical conductivity in sandwich geometry	94
(σ_{\perp})	
3.3.3 Field dependent electrical conduction in	97
Metal-Insulator-Metal structure	
3.4. Conclusion	104
References	106
CHAPTER IV	109
OPTICAL STUDIES IN MOLYBDENUM TRIOXIDE, VANADIUM PENTOXIDE, AND TITANIUM DIOXIDE FILMS	
4.1 Introduction	110
4.2 Theory	113



4.3	Experiment	118
4.4	Results and discussion	119
4.4.1	Optical constants	119
4.4.2	optical band gap	120
4.4.3	Infrared spectra of MoO_3 , V_2O_5 , and TiO_2 films	128
4.4.4	X-ray diffraction studies	130
4.4.5	Morphological studies	131
4.4.6	DC electrical conductivity while UV irradiation	132
4.5.	Conclusion	135
	References	136

CHAPTER V 139

THERMAL STUDIES IN MOLYBDENUM TRIOXIDE AND VANADIUM
PENTOXIDE FILMS

5.1.	Introduction	140
5.2.	Experiment	140
5.3.	Results and discussion	141
5.3.1.	TG-DTA studies	141



5.3.2. Thermo emf studies	144
5.4. Conclusion.	146
References	147

CHAPTER VI 148

ELECTRICAL AND OPTICAL STUDIES OF MIXED OXIDE
SYSTEMS OF MoO_3 AND V_2O_5 THIN FILMS

6.1 Introduction	149
6.2. Experiment.	151
6.3 Results and discussion.	152
6.4 conclusion	156
References	157



CHAPTER VII

158

DESIGN AND FABRICATION OF ELECTROCHROMIC WINDOWS USING
MOLYBDENUM TRIOXIDE AND VANADIUM PENTOXIDE

7.1	Introduction	159
7.2	Operating principle	160
7.3	Experiment	163
7.4	Results and Discussion	164
7.5	Conclusion	166
	References	167

