

Contents

	Page
Acknowledgment	
Summary	I
1. General Introduction.	1
Survey of the previous work on CuInS_2	4
a) Preparation and microstructure.	4
b) Optical properties.	10
Calculation of the optical constant	10
c) Electrical properties	19
1) D.C. properties	19
2) A.C. properties	24
2. Experimental techniques	29
2.1. Chemical method	29
2.1.1. Solution growth preparation	29
2.1.2. Techniques of chemical deposited films.	31
2.2. Thermal method	32
2.2.1. Material preparation	34
2.2.2. Techniques of thermal deposited films	37
2.3. Cleaning the substrate	37
2.4. Techniques of film thickness measurements	38
2.4.1. Weighting method	38
2.4.2. Optical method.	39

	Page
2.5. Techniques of thin film investigations	40
2.5.1. X-ray diffraction techniques	40
2.5.2. Scanning electron microscopy	41
2.5.3. Electrical techniques	42
a) D.C.method	42
b) A.C. method	43
2.5.4. Optical techniques	45
3. Microstructure analysis of CuInS_2	46
3.1. Chemical deposition process	47
3.2. Thermal evaporation process.	48
3.3. Results and discussion.	49
3.3.1. Theoretical calculation.	49
3.3.2. X-ray analysis	53
a) Chemical deposited films.	53
b) Thermal evaporated films.	57
3.3.3. Scanning electron microscopy (SEM)	60
4. Optical properties of CuInS_2	63
4.1. Optical absorption in semiconductor	63
4.1.a. Allowed direct transitions	64
4.1.b. Forbidden direct transitions.	65
4.2. Calculation of the optical constants.	65

	Page
4.3. Theory of calculation.	67
4.4. Present results and discussion.	69
5. Electrical properties of CuInS_2	78
5.A. D.C.results of CuInS_2 films	79
(chemical & thermal)	
5.B. A.C. results of CuInS_2 films	90
(chemical & thermal)	
- General conclusion	96
- References	106
-Figure Caption	
- Arabic summary	