

الآية

قال تعالى:

{يَسْأَلُونَكَ عَنِ الرُّوحِ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي
وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا}

صدق الله العظيم

Dedication

This work is dedicated to my dead father, my mother.
Also it is dedicated to my family, especially to my husband who
I will never be able to repay him for his absolute backing, my
daughters and to my brothers, sisters and my lovely friends.

Acknowledgment

I am thankful to Almighty Allah the Most Gracious, and the Most Merciful for who giving me the strength and health to complete this work. Special appreciation goes to my supervisor, *prof. Nafie AbdAl-lattief Almuslet* for his vital support. I am grateful for his help and fruitful devises. and his valuable constructive comments and suggestions throughout this research.

My thanks are extended to all teachers and technical staff of the institute of laser in Sudan University of science and technology and to my friends for their help and support.

Abstract

In this work, copper oxide (CuO) disks were prepared using a classical pressing machine, after mixing with potassium bromide. The disks were fabricated with different thicknesses (1.7, 2.59, 3.46, 4.29, 5.49, 5.92) mm.

The optical properties of CuO disk were studied using different types of monochromatic light sources in the wavelength range (300-950) nm.

The incident light intensities were measured in the absence of samples, which regarded as the reference (I_0), then the transmitted intensity (I_T) for each sample was measured by placing the monochromatic light source, the detector, and the sample on the same line. The reflected intensities (I_R) also were measured by placing the monochromatic light source and the detector at angle of 45° with the samples. The absorption coefficient for each sample was calculated using Beer-Lambert law. In addition, the refractive index for each disk also was calculated.

The optical properties (absorption coefficient, transmission percentage, and refractive index) of the fabricated disks, with different thicknesses, were plotted as a function of wavelengths of the light sources .

The obtained results showed the possibility of using the CuO disks as an optical filters in certain wavelengths or as reflectors for other wavelengths.

المستخلص

في هذا العمل تم تحضير اقراص من اوكسيد النحاس باستخدام طريقة الضغط التقليدية. حيث تم تحضير العينات بعد خلطها بكلوريد البوتاسيوم على شكل اقراص مضغوطة ذات سماكات مختلفة (1.7, 2.59, 3.46, 4.29, 5.49, 5.92) ملي متر

تم دراسة الخصائص البصرية لهذه الاقراص وذلك باستخدام أنواع مختلفة من المصادر الضوئية في مدى من الطول الموجي من 300 الي 950 نانومتر.

تم قياس النفاذية لكل عينة بوضع مصدر الضوء والعينة والكاشف الضوئي على إستقامة واحدة بحيث تصل الأشعة من المصدر إلى العينة ومنها إلى الكاشف مباشرة ، قيست شدة المصادر الضوئية قبل وضع العينات (I_0) . ثم بعد ذلك وضعت العينات بين المصدر والكاشف وقيست شدة الأشعة النافذة (I_T). وأيضا قيست شدة الأشعة المنعكسة (I_R) وذلك عن طريق وضع الكاشف والمصدر الضوئي بزاوية 45^0 بالنسبة للعينات . ثم تم حساب معامل الأمتصاص لكل عينة باستخدام قانون بير لامبرت، وأيضا تم حساب معامل الإنكسار لكل العينات.

رسمت العلاقات بين الخصائص البصرية للاقراص (معامل الامتصاص ، النفاذية كنسبة مئوية ، معامل الانكسار) كدالة للاطوال الموجية للمصادر الضوئية.

أظهرت النتائج التي تم الحصول عليها إمكانية استخدام اقراص اول اوكسيد النحاس كمرشحات بصرية في أطوال موجية معينة أو كعواكس لأطوال موجية أخرى.

TABLE OF CONTENTS

Title	Page
الآية	I
Dedication	II
Acknowledgement	III
Abstract	IV
المستخلص	V
CHAPTER ONE BASIC CONCEPTS	
1-1 Introduction	1
1-2 Study objectives	2
1-3 Thesis structure	2
1-4 Laser and its properties	3
1-5 Transparent and opaque materials	5
1-6 Spectroscopy and the Interaction of Light with Matter	5
1-6-1 Absorption	8
1-6-1-1 Beer-Lambert law	9
1-6-2 Attenuation	10
1-6-3 Reflection	11
1-6-4 Emittance	11
1-6-5 Dispersion	12

1-6-6 Scattering	15
1-7 Relationship between Transmittance, Reflectance, and Absorptance	15
1-8 Refractive Index and Extinction Coefficient	15
1-9: Intensity Measurement	16
1-9-1 Transmission Measurement	17
1-10 Literature Review	17
CHAPTER TWO	
THE EXPERIMENTAL PART	
2-1 Introduction	21
2-2 The materials	21
2-3 The setup	22
2-3-1 Lasers and Light Sources	22
2-3-1-1 Helium-Neon (He-Ne) laser	22
2-3-1-2 Diode Laser 532 nm	23
2-3-1-3 UV light Emitting Diode 365 nm	24
2-3-1-4 Omega Laser XP	25
2-3-1-5 Red Diode Laser 671 nm	27
2-4 The Photo-Detector	28
2-5 The Digital Multimeter DT-700D	28
2-6 Setup arrangement	29
2-7 The Experimental Procedure	30
CHAPTER THREE	
RESULTS AND DISCUSSION	
3-1 Introduction	32

3-2 Samples Results and Analysis:	32
3-2-1 The optical properties of the CuO disks	34
3-3 Conclusions	40
3-4 Recommendations	40
References	41

List of figures

Figures	Page
Figure (1.1) : Interaction of Radiation and Matter	7
Figure (1.2):Chromatic aberration in a simple lens: the focal length for blue light is shorter than for red light	14
Figure (1.3): Normal and anomalous dispersion. Anomalous dispersion occurs close to energy transitions from a lower to a higher energy level.	14
Figure (1.4): Energy balance of incident light upon interaction with a sample	16
Figure (2-1): the fabricated Copper Oxide (CuO) Disks	21
Figure (2-1): A sketch diagram of the experimental setup	22
Figure (2.2) a photograph for the setup arrangement	29
Figure (3-1): The CuO disks with different thicknesses	33
Figure (3-2): the transmission spectrum of CuO with different thicknesses	35
Figure (3-3): the absorption coefficient versus wavelength for CuO disks with different thicknesses.	37
Figure (3-4): the calculated refractive index versus wavelength for CuO disks	39

List of tables

Tables	Page
Table 2-1: Technical specifications of the He-Ne laser	23
Table 2-2: Specifications of diode laser 532 nm	24
Table 2-3: Characteristics of UV LED	25
Table 2-4: Technical specifications of Omega laser XP	26
Table 2-5: The technical specifications of Red diode laser 671 nm	27
Table 3-1: The calculated transmission (%) for each wavelength for CuO with different thicknesses	34
Table 3-2: The calculated absorption coefficients of the CuO disks in different wavelengths	36
Table 3-3: the calculated refractive index for each wavelength for CuO with different thicknesses	38