SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF GRADUATE STUDIES

FABRICATION OF CuO DISKS TO ATTENUATE AND FILTER SOME VISIBLE AND I.R. WAVELENGTHS

A THESIS SUBMITTED FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF M.Sc. IN PHYSICS

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Dedication

This work is dedicated to the marvelous success of my sister, Um-Alharith, at her B.Sc. final exams.
ACKNOWLEDGEMENTS

"Who does not thank people will never thank Allah"

First of all, I thank my god for the uncountable granted blessings and for the help in completion of this work.

I am indeed indebted to the expert guidance I received from my supervisor, Prof. Nafie, who very patiently gave me all the stimuli required to complete this work, and whose constant encouragement have made me go a head with this work, in spite of many set backs.

I am at loss when I think of expressing my sincere gratitude to those, who helped me in this work, with their assistance in various forms at various times. While the list is very large, to accommodate in this limited space, I will be failing if I do not mention the members of the department of chemistry ( at Sudan University of Science and Technology), my colleagues at the Institute of Laser, specially my classmate Suleiman Al-Tyib and Mr. Abbass, my classmates at the M.Sc. programme, specially Mr. Mustafa Ahmed, the staff of the Institute of Environment Researches,
and Mr. Asaad (at the department of chemistry, University of Khartoum).

It would never have been possible for me to complete this work without the support of my mother (to whom I owe everything), my two sisters, my wife and my brother, whom without their prayers, constant encouragement, continuous services and patience; this work would never have seen the light...

Finally, I would like to express my sincere appreciation to my two little daughters, whom their lovely smiles left a lasting fervent impressions on me.

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The main objective of this work is to design and fabricate suitable optical attenuators and filters for some wavelengths in the visible and the infrared regions of the electromagnetic spectrum. Selection of the attenuators materials was based mainly on the pre-spectroscopic investigations of these materials. These had been carried out using: UV-VIS. spectrophotometer, NIR spectrophotometer, and FT-IR spectrometer.

Using a classical pressing machine, copper oxide disks had been synthesized after mixing with potassium bromide. Two sets of disks were produced : a set with different concentrations of the CuO and constant physical thickness, and a set with different physical thicknesses and fixed concentration of CuO. The produced disks were rigid enough to be dealt with.
Using a photodetector, accompanied with digital multimeter, intensity attenuation measurements of these two sets for the wavelengths: 675, 820, and 1064 nm, were carried out. Graphs were plotted from the results and the absorptivities were calculated in each case showing a good liability of using these disks as good optical attenuators for the three tested laser beams at normal angle of incidence. It was noticed that the performance of the second set, with constant concentration of CuO, was better than the performance of the first set. This is because of the constant reflectance of the second set.

The spectral performance, extending from 200 to 25000 nm, of these disks were investigated. An optical pass-band filter in the middle IR region (2.5 – 25 μm) at wavelength (λ_m ~ 15.2 μm) with bandwidth of (Δλ/2 ~ 1.9 μm), and an absorption neutral density filter in the range: (2.5 ~ 10.0 μm) was obtained from the same materials and the same fabricated disks.

Based on the obtained results, some future works were suggested.

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