New Frontiers in Physical Science Research Vol. 1

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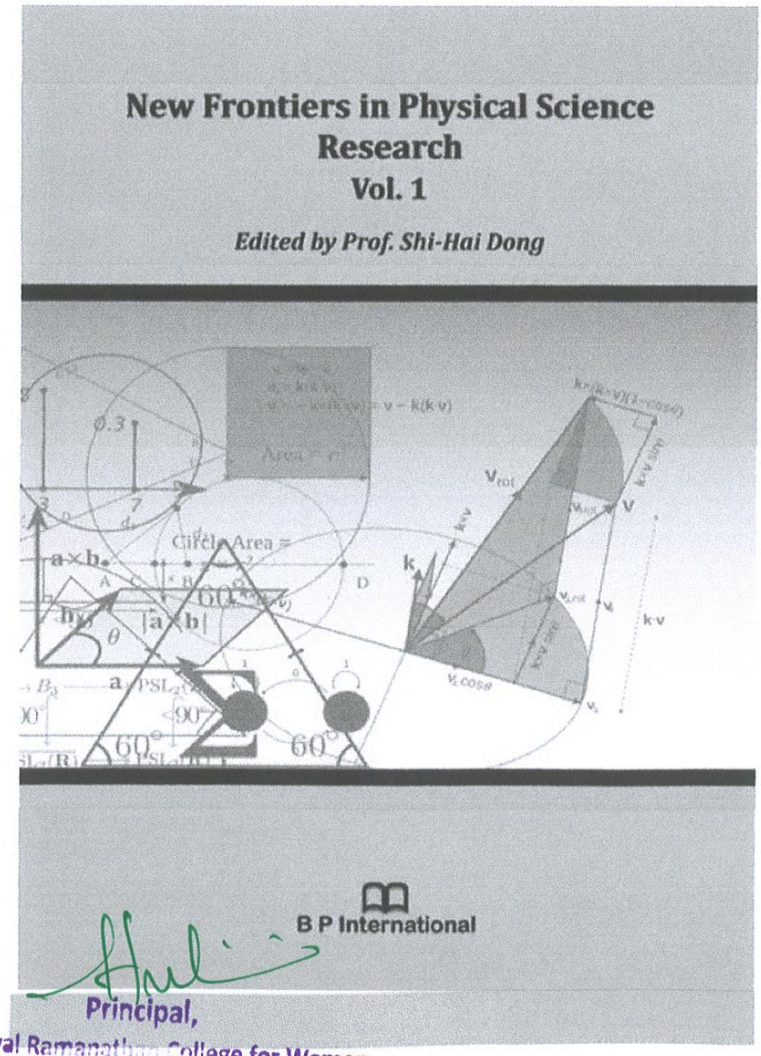

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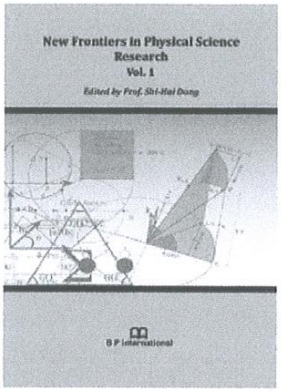

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This book covers key areas of Physical Science. The contributions by the authors include Electromagnetic waves, external magnetic field, electromagnetic electron cyclotron, dielectric tensor, Statistical mechanics, random matrix theory, quantum hall effect, Infrasound, space weather, climate change, biosphere of the earth, wind turbine rotor noise, noise of rocket engines, Hadronic matter, quark-gluon plasma, heavy-ion collisions, hyperon production, mid-rapidity multiplicity, nuclear spin, Interstellar space travel, limit of superheat, boiling point elevation, viscosity, magnetic bottle, positron, antihydrogen, Cell membrane, electropore, conductivity, probability, pulse electric field, Cu doped NiO thin films, transmittance, band gap, cyclic voltammetry, Longitudinal vortex, antigravity device, classic axiom, antigravity thrust, Side boundary membrane, hybrid structure of photon, cracks of the ice giants in Antarctica, Quantum probability, fuzzy event, path integral, and fuzzy graph. This book contains various materials suitable for students, researchers and academicians in the field of Physical Science.

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Chapter 7
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Optical and Electrochromic Properties of Pure and Cu-Doped NiO Thin Films

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ABSTRACT

Pure and Copper doped nickel oxide film was deposited on ITO-coated glass substrate by simple nebulizer technique at the substrate temperature of 350 °C. The effect of Cu content on NiO film's optical and electrochromic properties was characterized by UV-Vis-NIR spectrometer and cyclic voltammetry respectively. As the Cu content increases the transmittance decreases, consequently the band-gap energy wanes from 3.32 eV to 2.78 eV. The transmittance of both bleached state and colored state were significantly lowered for 0%, 5%, and 10% copper doped samples.

Keywords: Cu doped NiO thin films; transmittance; band gap; cyclic voltammetry (CV) studies.

1. INTRODUCTION

Nickel oxide thin films are gaining popularity due to their significance in numerous applications in science and technology. Nickel oxide may exist in various forms, like NiO, NiO_2, NiO_4, and Ni_2O_3. It is an attractive material to use as an antiferromagnetic layer, p-type transparent conducting film, as an active electrode in electrochromic devices, and as a functional sensing layer for developing chemical sensors. NiO exhibits a p-type semiconducting nature with a wide band gap energy in the range of 3.5-4.0 eV [1]. Electrochromism in NiO thin films is rather complicated, and there is no single accepted model for the mechanism that controls the coloring/bleaching process. It is generally accepted that the transition from a colored to a bleached state is related to the reversible transformation between Ni (II) and Ni (III) [2].

The optical properties of metal doped-NiO composite films are enhanced by doping metallic particles of the IB column elements in the periodic table, such as

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