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Optical Properties of Different Thin Film Thickness for (Fe_3O_4 - Ni_2O_3) Nano Material Using UV- Spectroscopy

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Abstract: *Thin film of (Fe_3O_4 and Ni_2O_3) Nano-material deposited on ITO glass substrate by spin coating method with different thicknesses (55.25, 78.7, 90.9 144.9 and 263.15) nm for each. Film thickness was measured by using the weight method. In this work study the effaced of different thicknesses on the optical parameters. For all samples the absorbance increases upon decreasing the thicknesses, while the transmission increases upon decreasing thicknesses and the reflectance in the wavelength 0.196nm is equal for all thicknesses.*

***Keyword**:* Thin Film, Absorbance, Transmission, Reflectance, thicknesses.

Introduction

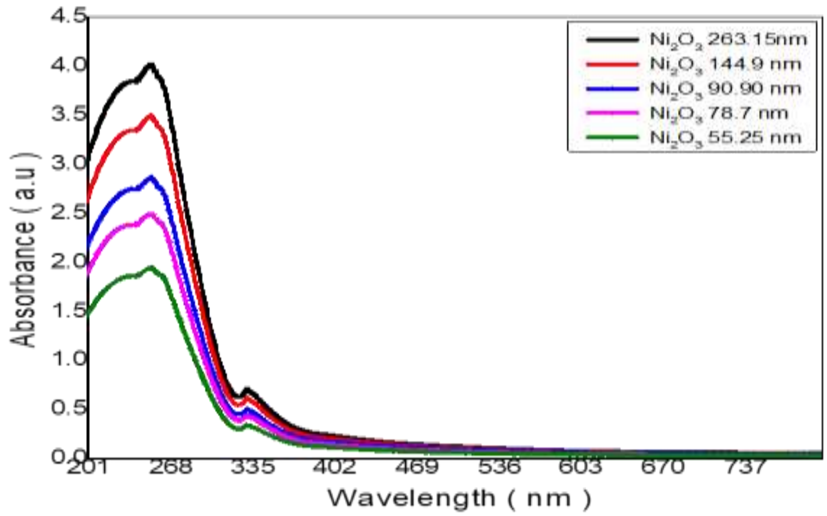
Nickel Oxide (NiO) is an important transition metal oxide with cubic lattice structure. Among the magnetic nanoparticles, fabrication of nickel nanoparticles is often more difficult than that of the other particles. This is because they are easily oxidized. To achieve pure nickel nano-crystals, numerous methods have been conducted in organic environments in order to prevent formation of hydroxide or oxidation [1]. Iron oxide nanoparticles (NPs) have attracted much consideration due to their unique properties, such as super paramagnetic, surface-to-volume ratio, greater surface area, and easy separation methodology. Various physical, chemical, and biological methods have been adopted to synthesize magnetic NPs with suitable surface chemistry [2].Optical property refers to a material's response to exposure to electromagnetic radiation and, in particular, to visible light. This section first discusses some of the basic principles and concepts relating to the nature of electromagnetic radiation and its possible interactions with solid materials. Next to be explored are the optical behaviours of metallic and non-metallic materials in terms of their absorption, reflection, and transmission characteristics. Electromagnetic radiation is considered to be wavelike, consisting of electric and magnetic field components that are perpendicular to each other and also to the direction of propagation; all electromagnetic radiation traverses a vacuum at the same velocity (3×10^8 m/s). Sometimes it is more convenient to view electromagnetic radiation from a quantum mechanical perspective, in which the radiation, rather than consisting of waves, is composed of groups or packets of energy, which are called photons. The energy E of a photon is said to be quantized, or can only have specific values [3].Light Interactions with Solids: When light proceeds from one medium into another (e.g., from air into a solid substance), several things happen. Some of the light radiation may be transmitted through the medium, some will be absorbed, and some will be reflected at the interface between the two media. For transparent materials, there is a relation between the index of refraction and the dielectric constant. The phenomenon of refraction is related to electronic polarization at the relatively high frequencies for visible light; thus, the electronic component of the dielectric constant may be determined from index of refraction measurements using Equation (9). Because the retardation of electromagnetic radiation in a medium results from electronic polarization, the size of the constituent atoms or ions has a considerable influence on the magnitude of this effect generally, the larger an atom or ion, the greater the electronic polarization, the slower the velocity, and the greater the index of refraction [4, 5]. Different attempts were made to account for optical properties of many metal oxides. In the work done by Khadija, it was shown that the increase of CuO concentration increase solar cell efficiency [6]

Material and Method

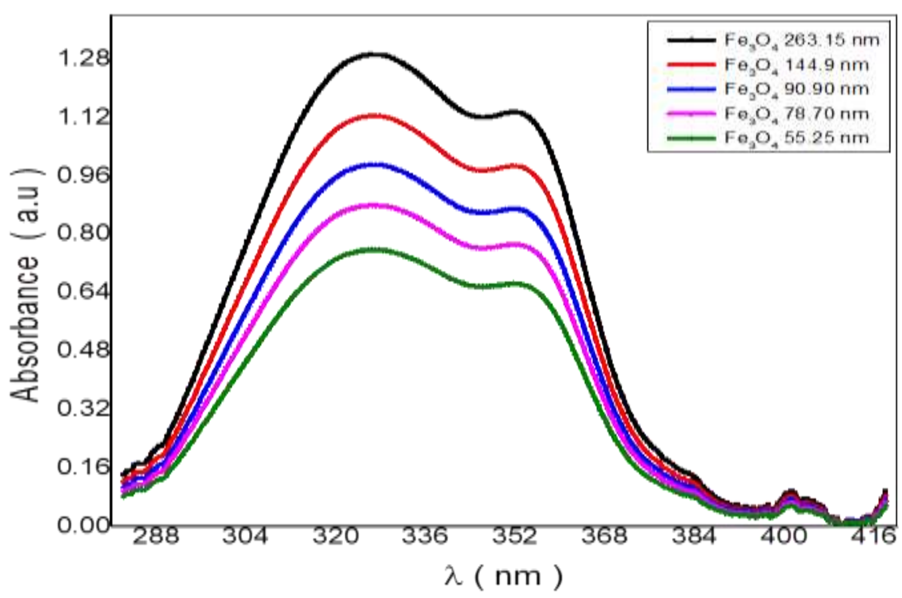
Samples Preparation

Nickel oxide thin films were prepared by spraying a 0.1 M solution of nickel nitrate of doubly distilled water onto the pre-heated amorphous glass substrates kept at (390˚C ± 10˚) C. Iron oxide thin films were prepared by spraying a 0.1 M solution of ferric nitrate of doubly distilled water onto the pre-heated amorphous glass substrates kept at (390˚C±10˚C). Film thickness was measured by using the weight difference method considering the substrate surface area and the density of the bulk nickel oxide. As the density of thin films was certainly lower than the bulk density, the actual film thickness would be larger than the estimated values the thickness of the thin film. The structural, optical characterization of the films deposited at optimized preoperative parameters was carried out.

Results



Fig(1) relation between absorbance and wavelengths of five sample that made by Ni_2O_3 in different thickness



Fig(2) relation between absorbance and wavelengths of five sample that made by Fe_3O_4 in different thickness

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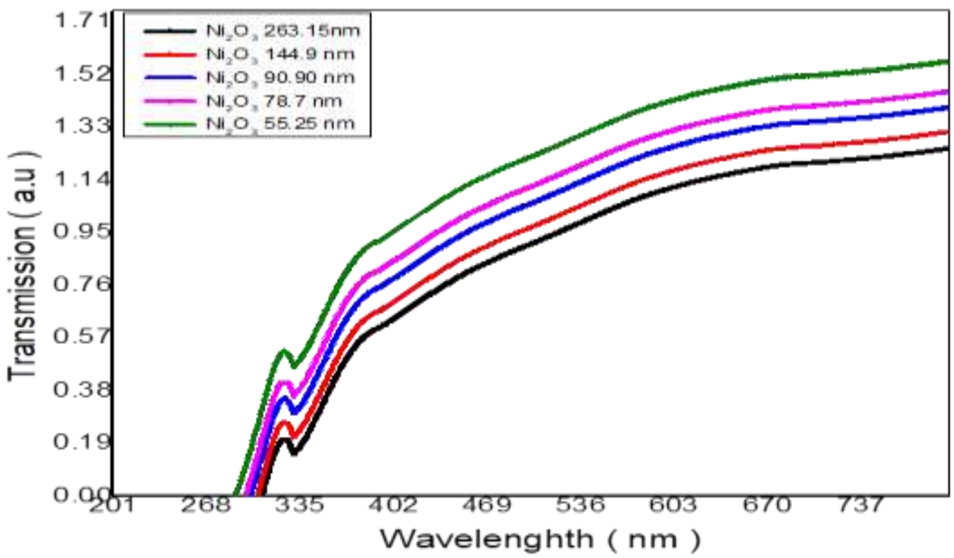
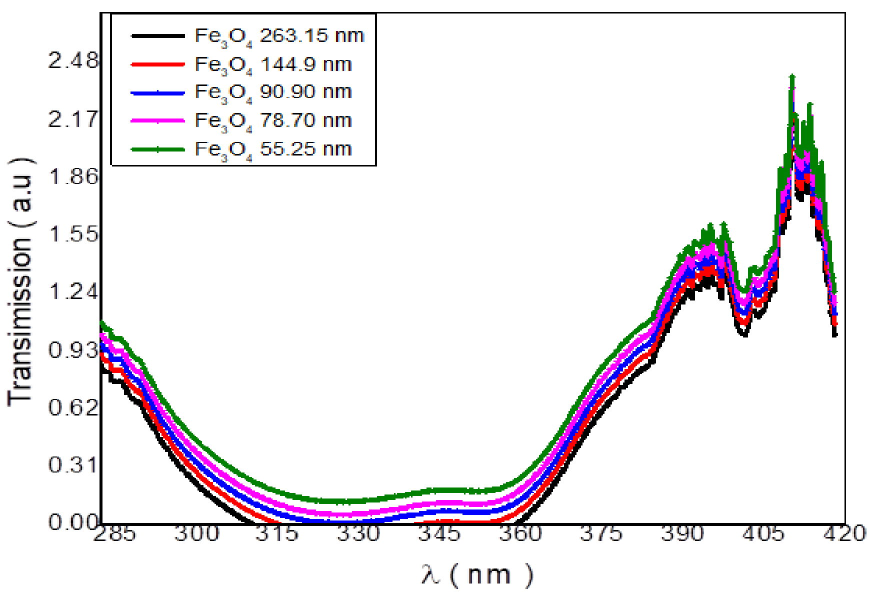
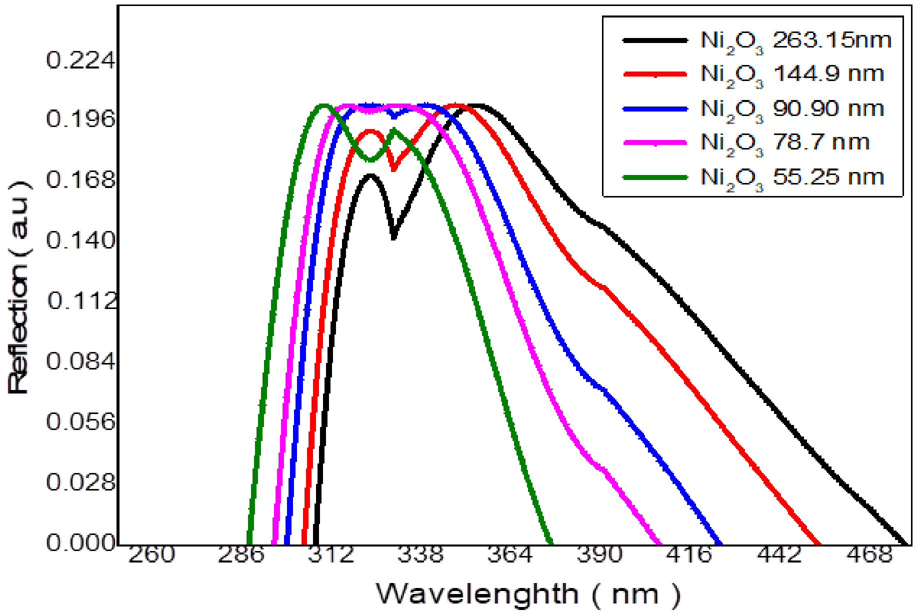


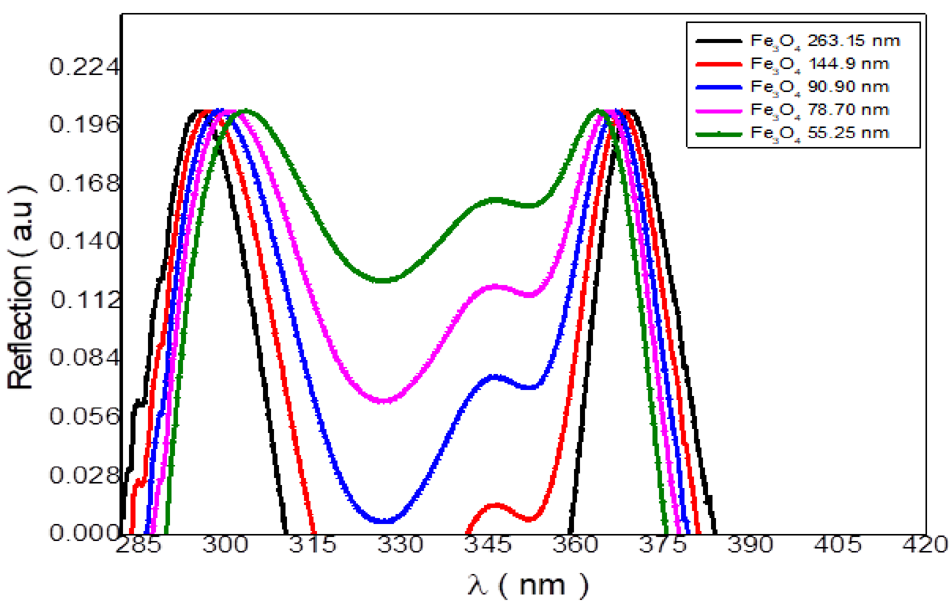
Fig(3) relation between transmission and wavelengths of five sample that made by Ni_2O_3 in different thickness



Fig(4) relation between transmission and wavelengths of five sample that made by Fe_3O_4 in different thickness



Fig(5) relation between reflection and wavelengths of five sample that made by Ni_2O_3 in different thickness



Fig(6)relation between reflection and wavelengths of five sample that made by Fe_3O_4 in different thickness

Discussion

The absorbance we found the behavior of curves is the same for all Ni_2O_3 and Fe_3O_4 samples in different thickness studied using UV-VS min 1240 spectrophotometer. Show all resolute of absorbance in fig (1) for Ni_2O_3 and Fig (2) for Fe_3O_4 samples. In fig. (1) and fig(2) shows the relation between absorbance and wavelengths for Ni_2O_3 and Fe_3O_4 samples in different thickness, the informly increase of the a absorption at wavelengths 252nm for Ni_2O_3 samples but for Fe_3O_4 at wavelength 326 nm . The effects of different thickness for Ni_2O_3 and Fe_3O_4 in the absorbance value increased when thickness value increase for all samples . In fig(3) and fig(4) shows the transimission for Ni_2O_3 and Fe_3O_4 samples in different thickness and we have dissicused in this secation from the renged (200 to 800 nm) for Ni_2O_3 samples and at reanged (309-359) nm for Fe_3O_4 samples . The transmittance spectra value curves reach's saturation above 665 nm for all Ni_2O_3 in different thickness samples. The average transmittance of Ni_2O_3 samples equal 1.495 (a.u) ,but for Fe_3O_4samples equal 1.59(a.u) . And in fig.(3) and fig(4) , the transmittance spectra value well be increase when the thickness of Ni_2O_3 and Fe_3O_4 samples decreased .Shows the results of reflectance spectra of the five samples was tretednent by Ni_2O_3 and Fe_3O_4 in different thickness in fig (5) and fig(6) . The reflectance spectra of Ni_2O_3 and Fe_3O_4 samples it has a maximum value at renged (308 - 356 nm) for all samples of Ni_2O_3 and (294-369) nm for Fe_3O_4 samples. And the refrance are in the(blue sheft) as wavelength when the thickness decreased for all samples of $Ni_2O_{3,}$ but for Fe_3O_4 are (red sheft) as wavelength when the thickness decreased.

Conclusion

The change of Fe_3O_4 and Ni_2O_3 thickness effect on absorbance, transmission and reflectance. For all samples the absorbance increases upon decreasing the thickness, while the transmission increases upon decreasing thickness and the reflectance in the wavelength 0.196nm is equal for all thickness.

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