

AN INVESTIGATION OF OPTICAL QUALITIES OF NICKEL OXIDE THIN FILMS DOPED WITH GOLD NANOPARTICLES BY THERMAL EVAPORATION PROCESS

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ABSTRACT

NiO thin films doped with three distinct convergences of Au nanoparticles (AuNPs) are stored on the glass slide substrates at 440oC by thermal evaporation strategy. The impact of AuNPs on the optical properties of NiO thin film is examined by the ultraviolet-visible spectra (UV-Visible). At this point when Au doping is made, the transmittance is diminished. The expanding or diminishing of refractive index and the real part of the dielectric constant as for expanding the doping fixations are relying upon the wavelength.

KEYWORDS: NiO, Au Nanoparticles, Thermal Evaporation & Ultraviolet-Visible Spectra

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INTRODUCTION

Nickel oxide is a direct conductive oxide and p-sort semiconducting material [1]. Since various uses of NiO, for instance, invention of sensors [2], impulses [3], unfriendly to ferromagnetic material [4], electrochromic devices [5]; it attracts the masters' thought towards it. A few techniques for getting ready the Nickel oxide thin films relied upon the applications, substance and physical, for example, sputtering [6] and pulsed laser deposition [7]. This paper reports the impact of AuNPs as a basic parameter on the plan of NiO thin films by thermal evaporation system.

The significant enthusiasm for thermal evaporation is because of its minimal effort, while it is progressively being utilized for some business forms, for example, the testimony of a straightforward layer on the glass [8].

THE EXPERIMENTAL PART

The NiO thin films were readied utilizing thermal evaporation technique. The NiO (1:1) powder from Sigma Aldrich Company is utilized to store 90nm thin film on the glass substrates at 440oC. Then again Gold powder (nanopowder, <150 nm molecule estimate, 99% follow metals premise Aldrich) was blended with NiO powder to make distinctive doping focuses (3%, 6%, 9%), and after that the outcome powders were saved on the glass substrates at 440oC by a similar strategy.

RESULTS AND DISCUSSIONS

Figure (1) shows the transmittance spectra of NiO thin films doped with different AuNPs. The transmittance diminishes the expanding doping fixation. This ceaseless reduction in transmittance is a direct result of grid surrenders. The nano Au⁺ may include interstitial site on the NiO grid and abatement transmittance of light, thus, the absorbance will increase. Additionally, it can be seen that expanding doping focus over 6%, nearly has no impact on the optical properties of the thin films.

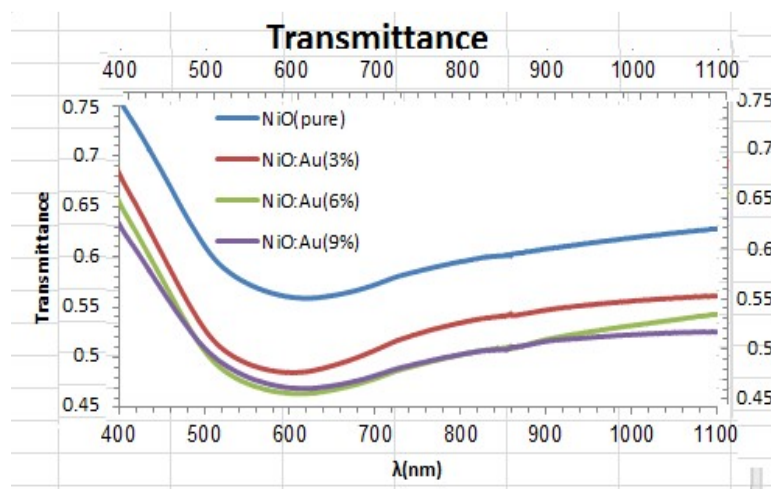


Figure 1: Transmittance as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au3%, NiO: Au6% and NiO: Au9%.

Figures (2) and (3) exhibit the absorbance and reflectance spectra of NiO thin films separately. The absorbance and reflectance both increase with the expanding doping fixations.

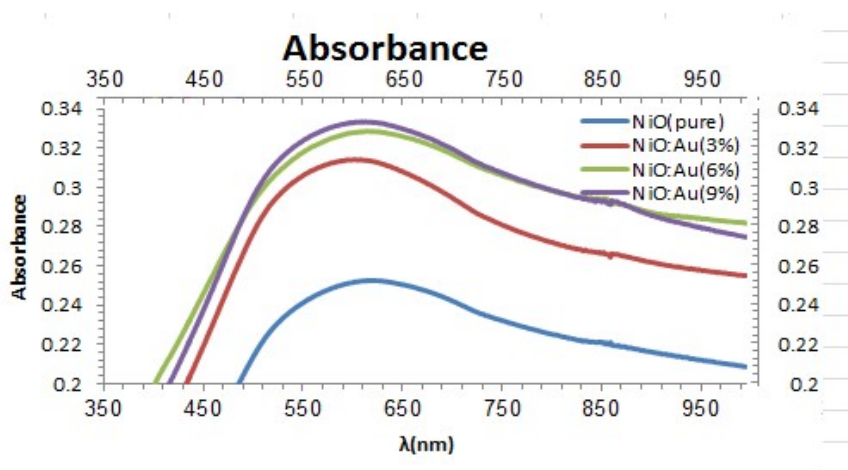


Figure 2: Absorbance as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au 3%, NiO: Au 6%, and NiO: Au 9%

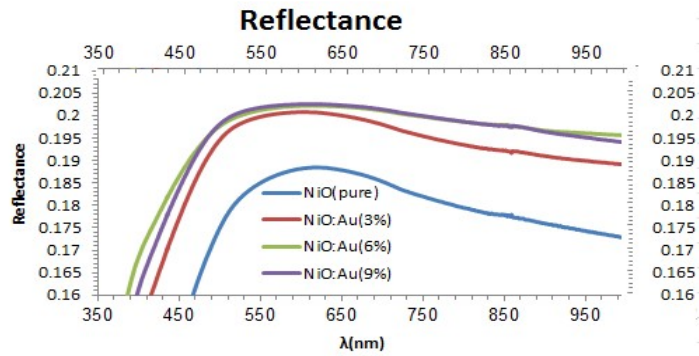


Figure 3: Reflectance as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au 3%, NiO: Au 6% and NiO: Au 9%

The absorption coefficient increases with the expanding doping focus as appeared in the figure (4). This is because of the connection amongst α and the absorbance on the off chance that we consider that the thickness is the same for all these thin films.

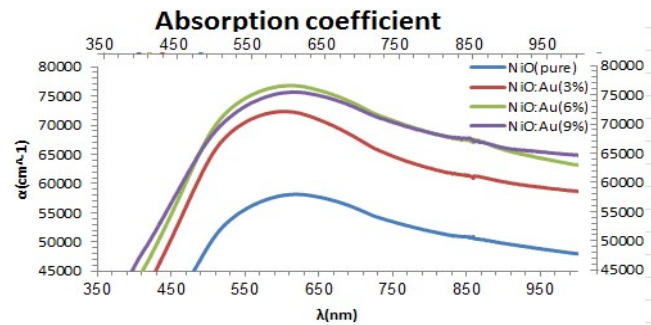


Figure 4: Absorption Coefficient as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au 3%, NiO: Au 6% and NiO: Au 9%

Refractive index and genuine piece of dielectric constant are both rely upon the wavelength as appeared in the figures (5) and (6). For wavelengths smaller than 600nm, both increases with the expanding doping fixations, however, for wavelengths more prominent than 600nm they diminish. Termination coefficient and imaginary part of the dielectric is constant both increase with the expanding doping focuses as appeared in the figures (7) and (8) separately.

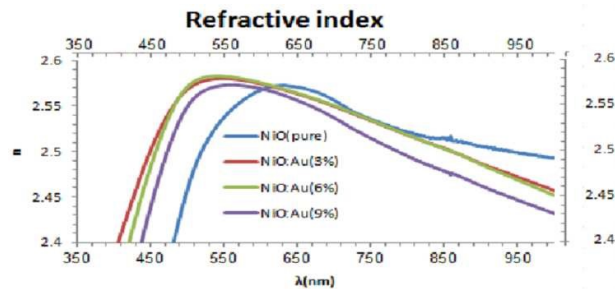


Figure 5: Refractive Index as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au 3%, NiO: Au 6% and NiO: Au 9%

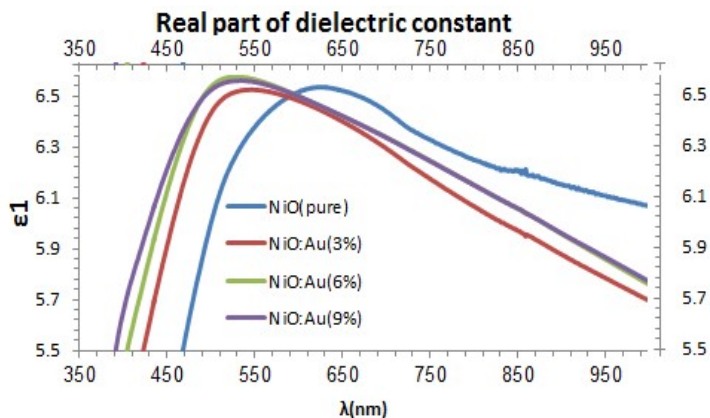


Figure 6: Real Part of Dielectric Constant as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au 3%, NiO: Au 6% and NiO: Au 9%

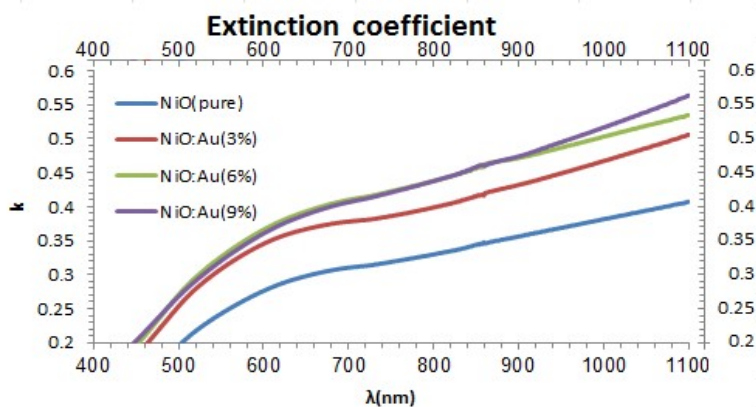


Figure 7: Extinction Coefficient as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; Pure NiO, NiO: Au 3%, NiO: Au 6% and NiO: Au 9%

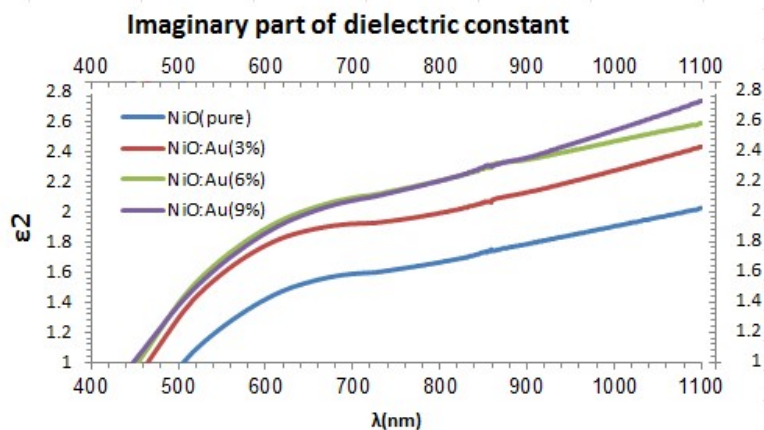


Figure 8: Imaginary Part of Dielectric Constant as a Function of Wavelength for Pure NiO and NiO: Au Films with Different Au Concentrations; pure NiO, NiO: Au 3%, NiO: Au 6% and NiO: Au 9%

The transmittance diminishes with the expanding doping fixations. This ceaseless decline in the transmittance is the result of cross section abandons. The expanding of doping fixation over 6% nearly has no impact on the optical properties of the thin films. Absorbance, reflectance, absorption coefficient, extinction coefficient and imaginary part of dielectric constant are on the whole increases with the expanding doping focuses. Be that as it may, the refractive index and the real part of dielectric constant are both rely upon the wavelength. For wavelengths smaller than 600nm, both increment with the expanding doping fixations, however, for wavelengths more noteworthy than 600nm they diminish.

REFERENCES

1. L Ai, G Fang, L Yuan, N Liu, M Wang, C Li, et.al. *Applied Surface Science* 2542401 (2008)
2. M Stamataki, D Tsamakis, N Brilis, I Fasaki, A Giannoudakos, and M Kompitsas *Phys. Stat. Sol. (A)*2052064(2008)
3. W Azelee, W Abu Bakar, M Yusuf Othman, R Ali, C Yong and S Toemen *Modern Applied Science* 335 (2009)
4. P Mallick and N C Mishra *American Journal of Materials Science* 266 (2012)
5. H Kamal, E K Elmaghraby, S A Ali, and K Abdel-Hady *Thin Solid Films* 483330 (2005)
6. A Mendoza-Galván, M A Vidales-Hurtado and A M López-Beltrán *Thin Solid Films* 517(2009)3115
7. I Valyukh, S Green, H Arwin, G A Niklasson, E Wäckelgård and C G Granqvist *Solar Energy Materials & Solar Cells* 94724 (2010)
8. S Major, A Banerjee, and K Chopra *Thin Solid Films* 108333 (1983)

