THE EFFECT OF NICKEL DOPING ON THE BAND GAP ENERGY OF TITANIUM DIOXIDE NANOPARTICLES
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Nanotechnology is a novel scientific branch for the treatment of matter with dimension size smaller
than 100 nm. The nanostructures are an intermediate structure between atomic structures and bulk
materials. Among nanostructures, nanoparticles are very interesting due to their large applications. For
example, titanium dioxide is one of the important semiconductors due to its morphology and a
crystalline phase. The disadvantage of TiO₂ is that its gap band is activated only under ultraviolet
radiation which presents a reliable percentage of the sunlight so we have to solve this problem.
Doping titanium dioxide remains the best solution for increasing its photocatalytic activities by using
metals or non-metals. Different methods have been used for the elaboration of metal-doped
titanium dioxide, including chemical precipitation methods, microemulsion methods, hydrothermal
methods and sol-gel processes using a variety of precursors such as titanium alkoxides, titanium
tetrachloride, titanium tetraisopropoxide…. But these methods are costly, toxic and high energy
requirement. Among these methods, the sol-gel method is a simple method to synthesis TiO₂
nanoparticles. In this study, we have prepared Nickel doped TiO₂ via sol-gel method. The obtained
nanoparticles were characterized by several analytical techniques like Diffuse reflectance spectroscopy
(DRS), Fourier Transform Infrared Spectroscopy, X-ray diffraction (XRD), Raman Spectroscopy and
Transmission Electron Microscopy (TEM). The DRS results show that the dopant Nickel accords a red
shift to light absorbing nature of TiO₂ and reduces its band gap energy significantly so that, it can
absorb energy from a major portion of visible light. The DRS of Nickel doped TiO₂ powders annealed
at 500°C presents a single broad intense absorption at around 400nm. The DRS spectra of Ni-doped
TiO₂ at Ni = 2.5% powders and calcined at 700°C show two wide absorption bands in the
wavelength ranges of 400–500nm and 650–850nm and the doped at 5/7.5/10% of Nickel present
three large absorption bands in ranges of 400nm, 400-500nm, and 650-1000nm. The degree of
absorbance of these latter peaks increased with the increase of Ni-doping concentration in TiO₂.

Keywords: Nickel doped TiO₂ nanoparticles, X-ray diffraction, Diffuse reflectance spectroscopy

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