Ain Shams University
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Preparation and characterization of semi-conductor nanoparticle materials used for some photocatalytic applications

A Thesis

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English summery

In this thesis, zinc oxide as one of the semiconductor materials, was prepared in the nano-size using sol-gel method. The starting materials for zinc oxide preparation were zinc nitrate and ammonium hydroxide. Triton X-100 was chosen to be used as a forming agent. Doping using silver ions from different sources was made for modification of zinc oxide and for improving its properties. Different ratios of each dopant were prepared and the photocatalytic activity of all the prepared ratios was studied by the photodegradation of different organic pollutants under ultra violet lamp and the most active ratios were studied in presence of sun light. Rhodamine B dye as a cationic dye and indigo carmine dye as an anionic dye, were taken as examples for organic pollutants. The most active ratios were chosen to be compared with zinc oxide before doping with respect to their physicochemical characterizations. Physicochemical characterizations were characterized using different techniques such as X-ray diffraction, Nitrogen gas adsorption at low temperatures, High resolution transmission electron microscope, HRTEM. Photo luminance, PL, Diffuse Reflectance Spectra DRS.

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List of abbreviations

AOP	Advanced oxidation process.
POPs	Persistent organic pollutants
CVD	Chemical Vapor Deposition
CVC	Chemical Vapor Condensation
RhB	Rhodamine B dye
IC	Indigo carmine dye
VB	Valence band
CB	Conduction band
NPS	Nanoparticles
MB	Methylene blue dye
c-ZnO	Commercial zinc oxide
p-ZnO	Prepared zinc oxide
X	The calculated electronegativity of the semiconductor
E_e	The free energy of free electron on the hydrogen scale (4.5 eV)
E_g	The estimated band gap energy of the semiconductor
XRD	X-ray diffraction
BET	Brunner-Emmett-Teller theory
HRTEM	High Resolution Transmission Electron Microscope
PL	Photoluminance
DRS	Diffuse Reflectance Spectra
FTIR	Fourier Transform Infrared Spectroscopy
ZnAg5	0.05 $AgIO_4$/ZnO and 0.05 AgI/ZnO
ZnAg10	0.10 $AgIO_4$/ ZnO and 0.10 AgI/ZnO
ZnAg15	0.15 $AgIO_4$/ ZnO and 0.15 AgI/ZnO
ZnAg20	0.20 $AgIO_4$/ ZnO and 0.20 AgI/ZnO

Chapter 1
Introduction