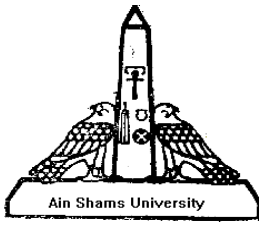


Faculty of Education
Chemistry Department

New Transition Metal Complexes and Lanthanide Based Nanomaterials: Preparation, Characterization and Potential Applications

Thesis Submitted

By

Radwa Mohammed Shokry Khaled Elbohy
B. Sc. & Ed., 2007

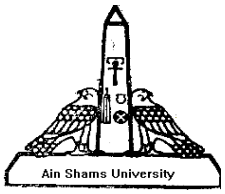
For

The Degree of
Master for the Teacher's Preparation in Science
(Inorganic Chemistry)

To

Chemistry Department
Faculty of Education
Ain Shams University
Cairo, Egypt

2014



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Under the Supervision of:

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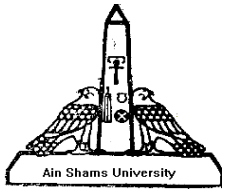

Faculty of Education
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Approval Sheet

Name of candidate : **Radwa Mohammed Shokry Khaled Elbohy**

Degree : **M. Sc. Degree for the Teacher's Preparation in Science (Inorganic Chemistry)**

Thesis Title: **New Transition Metal Complexes and Lanthanide Based Nanomaterials: Preparation, Characterization and Potential Applications**

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ABSTRACT

New non-toxic pure lanthanide based nanomaterials and transition metal nanocomplexes as well as dispersed into silica matrix were prepared for latent fingerprint detection and biomedical applications, respectively. The prepared nanomaterials were characterized using several advanced techniques.

The lanthanide based materials consist of pure x mol% $Eu^{3+}/Y_2Ti_2O_7$ and dispersed into silica matrix, where x = 1, 2, 4, 6, 10, 15 and 30. The pure $Eu^{3+}/Y_2Ti_2O_7$ and dispersed into silica materials have nanocrystalline structures with spherical shapes. The pure $Eu^{3+}/Y_2Ti_2O_7$ with different doping concentrations was characterized with faint orange red emission colour. Otherwise, $Eu^{3+}/Y_2Ti_2O_7$ dispersed into silica matrix powders give an intense pure red emission. The photoluminescence (PL) lifetime measurements showed that the $Eu^{3+}/Y_2Ti_2O_7$ dispersed into silica matrix was characterized with constant and high PL lifetime even at high doping concentrations in comparison with the pure samples. Judd–Ofelt calculations confirmed the experimental results. The obtained pure and dispersed into silica samples have very low toxicity. The prepared nanophosphor dispersed into silica matrix was successfully developing the latent

fingerprint from various forensic relevant materials, including non-porous, semi-porous and porous surfaces.

Also, chromone Schiff base complexes of Cu(II), Ni(II), Co(II), Fe(III), Zn(II), Cd(II) and UO_2(VI) as well as Zn(II) complex-silica xerogel nanohybrid were successfully prepared in nano domain with crystalline or amorphous structures. The spectroscopic data revealed that the Schiff base ligand behaves as a monobasic tridentate ligand. The coordination sites with the metal ions are the γ-pyrone oxygen, azomethine nitrogen and oxygen of the carboxylic group. The metal complexes exhibited octahedral geometry except Cu(II) complex which has a square planar geometry and UO_2 complex in which uranium ion is hepta-coordinated. Transmission electron microscope (TEM) analysis showed that Ni(II) and Zn(II) complexes have aggregated spheres and rod morphologies, respectively. TEM images of Zn(II) complex-silica xerogel nanohybrid showed a nanosheet morphology with 46 nm average size and confirmed that the complex was uniformly distributed into the silica pores. The obtained nanocomplexes were tested as antimicrobial and antitumor agents. The results showed that Zn(II) nanocomplex and Zn(II) complex-silica xerogel nanohybrid have high activity. The toxicity test on mice showed that

Zn(II) complex and Zn(II) complex-silica xerogel nanohybrid have lower toxicity than *cis*platin.

Finally, the obtained results showed that the prepared nanomaterials have great potential applications in the fields of forensic and medical sciences.

CONTENTS

CHAPTER II

Experimental Techniques and Methods

CHAPTER III

Production of Non-toxic Photoluminescent Pure $Eu^{3+}/Y_2Ti_2O_7$ and Dispersed into Silica Matrix Nanopowder for Latent Fingerprint Detection Application

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