Synthesis and characterization of new materials to be applied for hydrogen energy storage and water purification

Thesis submitted
to

The Faculty of Science,
Cairo University

by

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(B.Sc., Cairo University)

In partial fulfillment of the requirements

for

the degree of M.Sc. in Chemistry

2009

APPROVAL SHEET FOR SUBMISSION

Title of (M.Sc) Thesis:

SYNTHESIS AND CHARACTERIZATION OF NEW MATERIALS TO BE APPLIED FOR HYDROGEN ENERGY STORAGE AND WATER PURIFICATION

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This thesis has been approved for submission by the supervisors:

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Statement

Beside the work carried out in this thesis, the candidate has attended and successfully passed an examination in post-graduate courses during the academic year 2005-2006 covering the following topics:

1. Molecular structure
2. Molten metallurgy
3. Quantum chemistry
4. Nuclear chemistry
5. Advanced analytical chemistry
6. Catalysis and colloids
7. Physical polymers
8. Group theory
9. Adsorption
10. Electrochemistry
11. X-ray diffraction and thermal analyses
12. Electrode kinetics
13. Advanced inorganic chemistry
14. Volummetry
15. Thermodynamics
16. Mechanisms of inorganic chemistry
17. Statistical thermodynamics
18. Chelatimetry
19. Solar energy
20. German language

ACKNOWLEDGEMENT

The author wishes to express his gratitude to ***Dr. Mohammed S. Mansour****; dept. of phys. Chemistry, faculty of science, Cairo University, and to* ***Dr. Nahla Ismail****, dept. of phys. Chemistry, National Research Centre, Cairo, for their fatherly guidance, keen interest, supervision and kind help through the development of this thesis. Efforts of* ***Dr. Islam H. Abd El-Maksoud****, dept. of phys. Chemistry, National Research Centre are truly acknowledged. The author is deeply indebted for his suggesting the problem, close supervision of the experimental part and fruitful discussions towards the accomplishment of the work.*

List of Abbreviations

XRD : X-Ray Diffraction

SEM : Scanning Electron Microscopy

IR : Infrared absorption Spectra

D.S.C. : Differential Scanning Caloremetry

T.G.A : Thermogravimtery Analysis

ESR : Electron spin resonance

CTAB : N,N,cetyltrimethylammoniumbromide

TEAB : Tetraethylammoniumbromide

CEC : Cation Exchange Capacity

BET : Specific surface area

PCT : Pressure Composition Temperature Isotherm

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Results and Discussion

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SYNTHESIS AND CHARACTERIZATION OF NEW MATERIALS TO BE APPLIED FOR HYDROGEN ENERGY STORAGE AND WATER PURIFICATION

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Degree: *M.Sc.thesis, Faculty of Science, Cairo University, 2009*

ABSTRACT

Different types of titanosilicates (ETS-4, Natisite, and Sitinakite) were prepared using different precursors such as using natural SiO_2 from Red sea desert, without purification. Different techniques were used to characterize these titanosilicates such as XRD, IR, SEM, DSC-TGA, BET, ESR, ion exchanging and hydrogen energy storage. These studies showed that the prepared titanosilicates are well crystalline and possess high ion exchange capacity. Moreover, they exhibit shape selectivity towards adsorption of Cu^{2+} & Pb^{2+} ions from water where high adsorption was observed in case Pb^{2+} more than Cu^{2+} ions. Hydrogen adsorption isotherm measurements were carried out at -193^{o}C up to 20 bars in titanosilicate samples, physisorption of hydrogen was observed and microporous structure of Sitinakite samples showed maximum hydrogen adsorption capacity more than dense structure of Natisite and microporous ETS-4.

Key words: Titanosilicates, Zeolites, water purification, Ion exchange, renewable energy, hydrogen storage energy.

Supervisors:

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