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Zhao, Zheng W, The liquid-phase synthesis and electrochemical application of novel inorganic nanocomposites, PhD thesis, Institute for Superconducting and Electronic Materials, University of Wollongong, 2008. <http://ro.uow.edu.au/theses/49>

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The Liquid-Phase Synthesis and Electrochemical Application of Novel Inorganic Nanocomposites

A thesis submitted in fulfillment of the
requirements for the award of the degree

Doctor of Philosophy

From the
University of Wollongong

By

ZhengWei Zhao, M. Eng., B. Eng.

**Institute for Superconducting and Electronic
Materials**

Faculty of Engineering

2008

CANDIDATE’S CERTIFICATE

This is to certify that the work presented in this thesis is original and was carried out by the candidate at the laboratories of the Institute for Superconducting and Electronic Materials, the Faculty of Engineering, University of Wollongong, New South Wales, Australia, and has not been submitted for a degree to any other university or institution.

ZhengWei Zhao

ACKNOWLEDGEMENTS

I would firstly like to express my deep gratitude to my supervisors, Professor Hua Kun Liu and Dr Zai Ping Guo for their academic guidance, financial support, and constant encouragement throughout the project.

Many thanks should also be given to Prof. Shi Xue Dou, Dr. Guo Xiu Wang, Dr. Jia Zhao Wang, Mr. Min Sik Park, Mr. See How Ng, Ms. Sau Yen Chew, and all the members of the Institute for Superconducting & Electronic Materials, and to all the technicians at the Department of Materials Engineering. Thanks should also go to Dr. T. Silver for helpful comments and advice on this thesis.

TABLE OF CONTENTS

CANDIDATE'S CERTIFICATE	i
ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS	iii
ABSTRACT	vi
CHAPTER 1. INTRODUCTION	1
CHAPTER 2. LITERATURE REVIEW	4
2.1 Liquid-phase synthesis of inorganic nanocomposites.....	4
2.1.1 Co-precipitation synthetic methods	4
2.1.2 Microemulsion synthetic methods	21
2.1.3 Other synthetic methods	24
2.2 Lithium ion rechargeable batteries and anode materials.....	29
2.2.1. Lithium ion rechargeable batteries and anodes.....	30
2.2.2. Tin based anode materials.....	32
2.3 Direct methanol fuel cells and electrocatalysts.....	39
2.3.1 Direct methanol fuel cells	39
2.3.2 Electrocatalysts for direct methanol fuel cells	41
2.3.3 Electrocatalyst supports	46
2.4 Summary	56
CHAPTER 3. EXPERIMENTAL.....	58
3.1 Typical materials and chemicals.....	58
3.2 Experimental procedures	59
3.3 Structural and physical characterization of the nanocomposites	60
3.4 Electrode preparation	61
3.4.1 Electrode preparation for lithium ion batteries	61
3.4.2 Electrode preparation for direct methanol fuel cells.....	61
3.5 Test cell construction	62
3.5.1 Cell construction for lithium ion batteries	62
3.5.2 Cell construction for the direct methanol fuel cell.....	62
3.6 Electrochemical performance characterization.....	64
3.6.1 Electrochemical characterization for the lithium ion battery.....	64
3.6.2 Electrochemical characterization for direct methanol fuel cells.....	64
CHAPTER 4. ELECTROCHEMICAL LITHIATION AND DE-LITHIATION OF MWNT-Sn/SnNi NANOCOMPOSITES	66
4.1 Introduction.....	66
4.2 Synthesis and structure characterization of MWNT-Sn and MWNT-SnNi composites	67
4.2.1 Preparation of MWNTs.....	67

4.2.2 Preparation of MWNT nanocomposites with Sn and SnNi	68
4.2.3 Microstructural characterization	68
4.3 Electrochemical testing of nanocomposite electrodes	71
4.4 Conclusion	83
CHAPTER 5. MESOPOROUS CARBON-TIN NANOCOMPOSITES AS ANODE MATERIALS FOR THE LI-ION BATTERY	
5.1 Introduction.....	84
5.2 Synthesis and characterization of MC-Sn nanocomposite.....	85
5.2.1 Synthesis of the mesoporous carbon.....	85
5.2.2 Mesoporous carbon-tin nanocomposite	86
5.2.3 Microstructure characterization	86
5.3 Electrochemical testing of nanocomposite electrodes	88
5.4 Conclusion	92
CHAPTER 6. TITANIA NANOTUBE SUPPORTED TIN ANODES FOR LITHIUM INTERCALATION	
6.1 Introduction.....	93
6.2 Synthesis and characterization of titania nanotube supported tin.....	94
6.2.1 Synthesis of the titania nanotube supported tin anodes	94
6.2.2 Characterization of the titania nanotube supported tin anodes	94
6.3 Electrochemical properties of titania nanotube supported tin anodes	98
6.4 Conclusion	103
CHAPTER 7. NOVEL IONIC LIQUID SUPPORTED SYNTHESIS OF PLATINUM BASED ELECTROCATALYSTS ON MULTIWALLED CARBON NANOTUBES	
7.1 Introduction.....	104
7.2 Synthesis and characterization of the Pt/CNT nanocomposite	105
7.2.1 Microwave heated synthesis of Pt/CNTs.....	105
7.2.2 Characterization of the Pt/CNT nanocomposites.....	107
7.3 Electrochemical properties of Pt/CNTs	114
7.4 Conclusion	116
CHAPTER 8. PREPARATION OF POROUS CARBON SUPPORTED Pt NANOCOMPOSITES FOR DIRECT METHANOL FUEL CELLS	
8.1 Introduction.....	117
8.2 Synthesis and characterization of porous carbon Pt nanocomposites.....	118
8.3 Electrochemical properties of porous carbon Pt nanocomposites	122
8.4 Conclusion	125
CHAPTER 9. METHANOL TOLERANT Pt/FeO _x /C NANOCOMPOSITE CATHODES FOR DIRECT METHANOL FUEL CELLS	
9.1 Introduction.....	127
9.2 Synthesis and characterization of Pt/FeO _x /C nanocomposites	128
9.3 Electrochemical properties of Pt/FeO _x /C nanocomposites	133
9.4 Conclusion	136
CHAPTER 10. GENERAL CONCLUSIONS.....	
	137

10.1 Review of this study	137
10.1.1 Tin based nanocomposites for lithium ion battery anodes.....	137
10.1.2 Pt based nanocomposites for DMFC electrocatalysts.....	139
10.2 Suggestions for future study	141
REFERENCES	142
LIST OF SYMBOLS	159
LIST OF FIGURES	160
LIST OF TABLES	164
PUBLICATIONS.....	165

ABSTRACT

The aim of this study is to investigate various liquid-phase syntheses of novel inorganic nanocomposites for electrochemical power sources. Lithium ion batteries and fuel cells are two typical kinds of electrochemical power sources in the consumer electronics market. Lithium ion batteries are currently one of the most popular energy storage devices. Direct methanol fuel cells also have much potential as next generation electrochemical power sources, especially for small electronic devices.

Tin and Pt based nanocomposites are two types of inorganic materials studied in this work for use as alternative electrodes, as lithium ion battery anodes and as direct methanol fuel cell electrocatalysts, respectively. Different liquid-phase synthesis methods were employed to prepare these novel nanocomposites. Physical and electrochemical characterizations were carried out systematically on the as-prepared nanocomposites.

All of the results show that these novel inorganic nanocomposite materials are unique and good substitutes for the anode materials in lithium ion batteries or as electrocatalysts for direct methanol fuel cells.