

**HIGHER TECHNICAL INSTITUTE
MECHANICAL ENGINEERING DEPARTMENT**

DIPLOMA PROJECT

**STATUS AND TRENDS IN NANO-SCALE
ENGINEERING**

**BY
CHRISTOFOROS ATTAS**

JUNE 2003

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ENGINEERING**

by

Christoforos Attas

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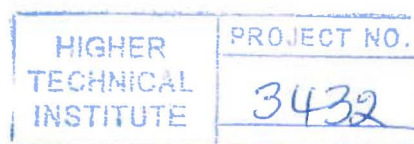
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Abstract

What could we humans do if we could assemble the basic ingredients of the material world? What if we could build things, the way nature does, atom by atom and molecule by molecule? We could be small Gods on earth that will construct whatever we want. Scientists already are finding answers to these questions. The field is roughly where the basic science and technology was prior to the invention of transistors in the late 1940s and 1950s. What is going to follow is a “road map” for the basic and most common fields of nanotechnology.

Table of Contents

• Abstract	
• Table of contents	
• Acknowledgements	
• Introduction	1-3
• <u>Chapter 1</u>	4-5
Overview	
• <u>Chapter 2</u>	
2.1 Synthesis and Assembly	6-7
2.2 Critical Issues for Nanostructure Synthesis and Assembly	8
2.3 Common Enabling Technologies	8-10
2.4 Nanoparticle Synthesis Strategies	10
2.4.1 Gas Phase Synthesis and Sol-Gel Processing	10-11
2.5 Other Strategies	11
2.5.1 Bottom-Up Approach	11-12
2.5.2 Top-Down Approach	12
2.6 Other Synthesis Issues	12
2.6.1 Means to achieve Monodispersity	12-13
2.6.2 Scale-up	13
2.6.3 Building Nanoparticle Chains or Wires	13-14
2.6.4 Building Nanometer Fibers or Tubes	14
2.7 Biogenic Strategies	14-15
2.7.1 Self-Assembly as a Deliberate Strategy	15
2.7.2 Natural Templates or “Scaffolds”	15-16
• <u>Chapter 3</u>	
3.1 Dispersions and Coatings	17
3.2 Property Amplification	18-19
3.3 Enablers	19-20

3.4 Applications	20-22
3.5 Work all-over the world	22-25
3.6 Challenges	25

- **Chapter 4**

4.1 High Surface Area Materials	26-29
4.2 Opportunities for Clusters and Nanocrystalline Materials	29-30
4.3 Opportunities in Self-Assembly	30
4.3.1 Zeolitic Materials	31-33
4.3.2 Carbon Materials	33-35
4.3.3 Microporous and Dense Ultrathin Films	36
4.4 Opportunities in Characterization and Manipulation at the Nanoscale	36-37

- **Chapter 5**

5.1 Functional Nanoscale Devices	38-40
5.2 Single-Charge Electronics	40-41
5.3 Nanomagnetism	42-45
5.4 Quantum Dot Lasers	45-47
5.5 Carbon Nanotubes	47-49

- **Chapter 6**

6.1 Bulk Behavior of Nanostructured Materials	50
6.2 Mechanical Behavior: Structural Nanostructured Materials	50-51
6.2.1 Elastic Properties	51
6.2.2 Hardness and Strength	51-53
6.2.3 Ductility and Toughness	53-55
6.2.4 Superplastic Behavior	55
6.2.5 Unique Mechanical Properties of Nanocrystalline Materials	55-56
6.2.6 Theoretical Needs	56
6.2.7 Properties of Nanostructured Alloys	57-58
6.2.8 Opportunities and Challenges	58-59
6.3 Ferromagnetic Nanostructured Materials	59
6.3.1 Soft Magnetic Nanocrystalline Alloys	59-60
6.3.2 Permanent Magnet Materials	60-61
6.3.3 Giant Magnetoresistance (GMR)	61-62
6.3.4 Other Ferromagnetic Nanocrystalline Materials	62

6.3.5 Opportunities and Challenges	62
6.4 Other Bulk Applications of Nanostructured Materials	63
6.4.1 Nanocrystalline Hydrogen Storage Materials	63
6.4.2 Nanocrystalline Corrosion-Resistant Materials	63
• Conclusions	64
• Appendix	
• References	

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INTRODUCTION

Nanostructure science and technology is a broad area of research and development activity that has been growing explosively worldwide in the past few years. It has the potential for revolutionizing the ways in which materials and products are created and the range and nature of functionalities that can be accessed. It is already having a significant commercial impact, which will assuredly increase in the future.

The purpose of this study was to designate the current status and future trends internationally in research and development in the broad and rapidly growing area of nanostructure science and technology. There were four goals to be achieved:

1. To provide a broadly brief and critical view of this field,
2. To identify promising areas for future research and commercial development,
3. To specify the need of interdisciplinary international collaboration,
4. To identify opportunities for international collaboration.

The essential theme of the field is that we are now able to make nanostructure materials that are characterized by innovative performance. It represents the beginning of a revolutionary new age in the ability to manipulate materials for the good of humanity. Every year more research is done. New ideas and opportunities explode internationally in the field, since the realization that by creating new materials from nanoscale building blocks, new properties and functionalities can be accessed in unprecedented ways by the controlled synthesis of the materials in nanometer dimensions. Worldwide research expands rapidly nowadays exploring and exploiting the opportunities that nanostructuring offers.

Many aspects of the field existed well before nanostructure science and technology. The past decade it became a coherent field of endeavor through the confluence of three important technological streams:

1. New and improved control of the size and manipulation of nanoscale building blocks,
2. New and improved characterization of materials at the nanoscale dimensions,
3. New and improved understanding of the relationships between nanostructure and properties and how these can be engineered.

As a result of these developments, a wide range of new opportunities for research and applications in the field are now present. The following table indicates some examples of applications with a significant technological impact.