HIGHER TECHNICAL INSTITUTE
MECHANICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

STATUS AND TRENDS IN NANO-SCALE ENGINEERING

BY
CHRISTOFOROS ATTAS

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Christoforos Attas

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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.

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Over the period that I devoted for the completion of this project I confronted many challenges as well as difficulties. I have enriched my knowledge on the particular subject that my project deals with, through the useful sources I have read. However, I also faced some difficulties particularly with the unfamiliar vocabulary and terminology, which was present in the sources. Therefore, without the helpful feedback of my supervisor, Dr Nicos Angastiniotis, it would have been impossible to complete this task.

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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.