

NANOSCIENCE AND NANOTECHNOLOGY HANDBOOK

Author: H. Panda

Format: Paperback

ISBN: 9788178331263

Code: NI225

Pages: 608

Price: Rs. 1,675.00 **US\$** 44.95

Publisher: Asia Pacific Business Press Inc.

Usually ships within **5** days

Nanotechnology is the engineering of functional systems at the molecular scale. In its original sense, nanotechnology refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete, high performance products. In this rising world of rapid technological developments, the role of state of art materials & composites is pivotal in frontier applications like aerospace, aviation, automobile, defense, electronics, chemical, biomedical, energy & nuclear sectors etc. with the advent of 21st century & initiation of Nanotechnology the atomic & molecular structures of materials is redefined. This shall result in new smart materials namely nanoparticles, powder, wires, rods, carbon nano tubes & so on. Nanotechnology is very diverse, ranging from novel extensions of conventional device physics, to completely new approaches based upon molecular self-assembly, to developing new materials with dimensions on the nanoscale, even to speculation on whether we can directly control matter on the atomic scale. Potential of nanotechnology to manipulate and program matter with atomic precision has invited the attention of scientists to explore innumerable applications of nanotechnology was an inspiration for the benefit of researchers, academicians and industries associated with this field. The global market for nanotechnology products is worth an estimated compound annual growth rate (CAGR) of 11.1% from 2010 to 2015. The largest segment of the market, made up of nanomaterials, is expected to increase at a 5 year CAGR of 14.7%.

This book basically deals with design of protein based nanomachines, metastabilities in nanocrystalline, nanoscale characterization of nanowires, thermopower measurements on nickel nanowires, a nanoporous tio₂ electrode, nanoscale in investigation of ultrathin, silicone oxide thermal decomposition, cylindrical nanodot arrays, nanocrystalline silicon films, dispersion of carbon nanotubes, electrical conductivity study of nanocomposite films, magnetic properties of nanospheres, generation spectroscopy of nanoparticle monolayer, au nanoparticles on light emitting polymers, etc.

This handbook deals with the technology frontiers, its applications, the current & future challenges etc. This book will be an invaluable resource to all academicians, industrialists, scientists, upcoming entrepreneurs & technocrats.

Contents

PREFACE

1. DESIGN OF PROTEIN BASED NANOMACHINES

Introduction

Renowned Nanomachines of the Biological Cell Confirm Engineering Principles and Inspire Nanomachine

Design

De Novo Design of Diverse Elastic-Contractile Protein Machines

Hydrophobic and Elastic Consilient Mechanisms: Definitions

Hydrophobic Consilient Mechanism and the Inverse Temperature Transition

The Elastic Consilient Mechanism and the Nature of Near Ideal Elasticity

Coupled Hydrophobic and Elastic Consilient Mechanisms

Principal Thermodynamic Quantities Controlling Diverse Energy Conversions in Model Proteins

The Change in Gibbs Free Energy for Solubility, $\Delta G(\text{solubility}) = \Delta H - T\Delta S$

The Change in Gibbs Free Energy for a Phase Transition

The Change in Gibbs Free Energy for an Inverse Temperature Transition

Apolar-Polar Repulsive Gibbs Free Energy of Hydration, ΔG_{ap}

Calculations of the Entropic Elastic Force and Energy

Biology's Protein-based Nanomachines Confirm the Hydrophobic and Elastic Consilient Mechanisms

The Three Classes of Energy Conversion Within the Cell

Complex III of the Electron Transport Chain Within the Inner Mitochondrial Membrane

ATP Synthase of the Inner Mitochondrial Membrane

The Myosin II Motor of Muscle Contraction

Confirmation of the Hydrophobic and Elastic Consilient Mechanisms

Designing Protein-based Nanomachines Using the Hydrophobic and Elastic Consilient Mechanisms

Design of an AFM-Based Stress-Strain Nanomachine for the Detection of a Single Molecular Event

Use of the 3 kHz Mechanical Resonances in the Design of an AFM-Based Nanomachine for Detection of Interactions at Fixed Length

An Additional Opportunity in the Deciphering of Engineering Principles for the Design of Protein-Based Nanomachines

2. METASTABILITIES IN NANOCRYSTALLINE

SILICON

Experimental Procedure

Results

Discussion

Conclusion

3. INTERACTION OF SULPHURIC ACID WITH

GRAPHENE

Sulphuric Acid in Gas and Solid Phases

Sulphuric Acid on Graphene

Conclusions

4. NANOSCALE CHARACTERIZATION OF

NANOWIRES

Experimental Methods

Nanowire Morphology, Periodicity and Diameter

Chemical Analysis of the CoPt/Pt Nanowires

Structural Analysis of the CoPt/Pt Nanowires

Discussion

Conclusions

5. THERMOPOWER MEASUREMENTS ON NICKEL

NANOWIRES

Experimental Details

Results and Discussion

Structural Characterization of the NWs

Initial Characterization of the Measurement Device

6. MULTI-WALLED CARBON NANOTUBE EMITTERS

EXPERIMENT

Fabrication of CNT Cathode

Experimental Structures

Current-Voltage Characteristics

Simulations

Simulated Structures

Predicted I - V Characteristics

Cathode Support Structure Geometry

Conclusion

7. VIBRATION OF A CARBON NANOTUBE

The Model for a CNT filled with a C-chain

Vibration of a CNT filled with a C-chain

Axisymmetric Radial Breathing Vibration ($n = 0$)

Coupled Vibration with $n = 1$

Vibration of Higher-order Modes ($n > 2$)

Conclusions

8. A NANOPOROUS TiO_2 ELECTRODE

Experimental Details

Preparation of the ILSE Films

Characterization of the ILSE Films

Electrode and DSSC Fabrication Containing the ILSE

Electrode Characterization

Results and Discussion

Conclusions

9. FREEZING BEHAVIOUR OF AN NANOMETER-SIZED Au DROPLET

Numerical Simulations

Results and Discussion

Conclusions

10. NANOSCALE INVESTIGATION OF ULTRATHIN SILICONE OXIDE THERMAL DECOMPOSITION

Experimental Details

Results and Discussion

High Temperature STM in situ Observation of the Thermal Decomposition Process

Individual Void Growth Kinetics at the Initial Decomposition Stage

Decomposition Rate Variation and Rate Limiting Steps

Morphology Effects on the Decomposition Process

Conclusions

11. CARBON NANOTUBE FIELD-EFFECT TRANSISTOR

Methodology

Results and Discussion

Conclusions

12. CYLINDRICAL NANODOT ARRAYS

System and Units

Theoretical Model

Vortex-core Magnetization

Total Energy Calculation

Results and Discussion

Conclusions

13. SUPERELASTICITY OF ENGINEERING CERAMICS BY NANOTUBES

Experimental Details

Results and Discussion

Conclusion

14. POROUS ANODIC ALUMINA

Experimental Details

Results

Initial Specimens and Anodizing

Film Morphology

Film Composition

Discussion

Conclusions

15. METAL NANOCLUSTERS IN GLASS

Experimental Procedure

Results and Discussion

Ion-Beam Mixed Ag in Silica

Ion-Exchanged Ag in Soda Lime Glass

Conclusion

16. LIGHT EMISSION FROM NANOCOMPOSITES

Experiments

Results and Discussion

Conclusion

17. NANOCRYSTALLINE SILICON FILMS

Experimental Details

Results

Optical Absorption Study

X-ray Diffraction Study

Infrared Absorption Study

Raman Study

Electron Microscopy

Discussion

Conclusion

18. CARBON NANOTUBES IN CHEMICAL VAPOUR DEPOSITION

19. NANOSCALE DEEP INDENTATION

Simulation Methodology

Results and Discussion

Conclusion

20. REDUCTION OF NANOWIRES

Experimental Details

Results and Discussions

Summary and Conclusion

21. DISPERSION OF CARBON NANOTUBES

Experimental Details

Purification and Dispersion of MWCNTs

Preparation of Nanocomposite Films

Carbon Nanotube Dispersion Study in Solution and in Nanocomposite Films

Electrical Conductivity Measurement

Results and Discussion

MWCNT Dispersion in Solution

Nanocomposite Preparation and Carbon Nanotube Distribution in Composite Films

Electrical Conductivity Study of Nanocomposite Films

Conclusion

22. CREATION OF CARBON ONIONS AND COILS

Experimental Details

Result and Discussion

Conclusions

23. MAGNETIC PROPERTIES OF NANOSPHERES

Experimental Details

Results and Discussion

Conclusion

24. LUMINESCENCE OF CRYSTALS NANORODS

Experimental Section

Results and Discussion

Conclusions

25. NANONECKLACE MORPHOLOGY

Experimental Details

Growth of Cu-Pt Nanoparticles

Growth of Cu-Pt Nanonecklace Nanowires

Conclusions

26. OPTICAL PROPERTIES OF NANODOT ARRAYS

Experimental Details

Results and Discussion

Conclusions

27. GENERATION SPECTROSCOPY OF NANOPARTICLE MONOLAYER

Experimental Section

Materials

Synthesis of AuNPs

Synthesis of Dense AuNPs Monolayer

Dodecanethiol SAM Formation

Characterization

SFG Set-up

Results and Discussion

Conclusions

28. CHEMICAL DOPING WITH CARBON NANOTUBES

Experimental Details

Results and Discussion

Summary

29. DIRECT-WRITE PROGRAMMING OF NANOSCALE DEMULTIPLEXER ARRAYS

30. POLY(N-ISOPROPYLACRYLAMIDE)

NANOPARTICLES

Introduction

Experimental Details

PNIPAM-coated Fe₃O₄@SiO₄@CdTe Nanoparticles and ZnPcS Loading

Biological Systems

PL and Fluorescence Measurements

ZnPcS Released from the Nanoparticles in PBS Solution

ZnPcS Released from the Nanoparticles in the CHO Cells

Results and Discussion

ZnPcS Embedded in the PNIPAM of Nanoparticles

Release of ZnPcS from the ZnPcS-loaded Nanoparticles in PBS Solution

Release of ZnPcS from the ZnPcS-loaded Nanoparticles in CHO Cells

Release of ZnPcS from the ZnPcS-loaded Nanoparticles in Zebra Fish

Movement of the Nanoparticles in Zebra Fish by the Magnetic Field Gradient

Phthalocyanines and PDT

Conclusion

31. COBALT FERRITE NANOPARTICLES

Experimental Details

Synthesis

Characterization Methods

Results and Discussion

Fundamental Characteristics, Crystallite size Versus Coercivity and Remanence

Mossbauer Spectra and Distribution of Cations

Heating Efficiency from Calorimetric Measurements and ac

Hysteresis Loops

Conclusions

32. Au NANOPARTICLES ON LIGHT-EMITTING POLYMERS

Experimental Section

Measurements

Device Fabrication and Characterization

Materials

Synthesis of PDOFT-bis-4-thiol

End-capping at AuNP onto PDOFT-bis-4-thiol (PDOFT-Au 10, PDOFT-Au15, PDOFT-Au 20 and PDOFT-Au 30)

Results and Discussion

Synthesis and Characterization

Photophysical Properties

Electroluminescent Properties and Current Density-Voltage-Luminescence (J-V-L) Characteristics of the PLED Devices

Conclusions

33. CARBON NANOSTRUCTURE BASED NANOCOMPOSITES

Experimental Details

Results and Discussion

Conclusions

34. Au NANOPARTICLE CHAINS

Experimental Results and Discussion

Sample Preparation and Measuring System

General Considerations on Dielectrophoresis

Dielectrophoresis on Flat Substrates

Dielectrophoresis on V-groove-etched Substrates

Discussion of Results on Patterned Substrates, Electric Field Numerical Calculation

CONCLUSION

35. GOLD-SILICA NANOCOMPOSITES

36. NANOPINS BY CHEMICAL VAPOUR DEPOSITION

Experimental Section

Preparation

Characterization

Results and Discussion

Conclusions

37. OXIDATION RESISTANT METAL NANOPARTICLES

Experimental Details

Thermo-Gravimetric Studies

Particle Size Reduction

Synthesis and Coating of Metal Nanoparticles

Results and Discussion

Thermo-Gravimetric Analysis

Fluidized Bed Processing

Particle Size Reduction

Passivation of Metal Nanoparticles by in situ ALD

Conclusions

38. MOLECULAR CARBON-ONIONS

Experimental Details

Discussion of Results

Conclusion

39. ATOMIC SCALE MANIPULATION

Tip-Surface Interaction

Experimental Response

Discussion and Conclusion

40. SILICONE NANOWIRES

Experimental Session

Results and Discussion

Conclusion

41. CARBON NANOFIBERS

Experimental Details

Results

Discussion and Conclusion

42. SINGLE-CRYSTALLINE NANOWIRES

Experiments

Results and Discussion

Conclusion

43. SILICONE OXIDE NANOSTRUCTURES

Experimental Details

Results and Discussion

Conclusion

44. A SQUARE TITANIUM NANOMESH

Experimental Details

Results and Discussion

Conclusions

45. NANO-POROUS ANODIC ALUMINIUM OXIDE MEMBRANES

Experimental Details

Results and Discussion

Conclusions

46. Co NANOPARTICLES

Experimental Section

Materials

Synthesis and Assembly of Cobalt Nanoparticles

Characterization

Results and Discussion

Conclusions

47. ZERO-BIAS CONDUCTANCE OF GOLD MOLECULAR JUNCTION

Methodology

Results and Discussion

Conclusion

48. ALL-INKJET-PRINTED ELECTRONICS OF METAL NANOPARTICLES

Fabrication and Experimental Details

Nanoparticle Solution Preparation

Semi-conducting Polymer Preparation

Organic Field Effect Transistor Fabrication Process and Characterization (Inkjet Printing of Nanoparticle Solution, Polymer Dielectric Layer and Semi-conducting Polymer)

Results and Discussion

Nanoparticle Sintering Characterization

OFET Characterization

Summary

49. TRIODE TYPE CARBON NANOTUBE FIELD EMITTER

Experimental Details

Results and Discussion

Conclusions

50. PROTEIN AND POLYMER IMMOBILIZED NANOPARTICLES FOR BIOMEDICAL APPLICATIONS

Methodology

Chemicals and Materials

Experimental Set-up

Analyses

Results and Discussion

Protein Estimation

Conjugation Studies

Magnetic Studies

Microscopy Studies

Cytotoxicity Studies

Leaching Studies

Hyperthermia Studies

Conclusion

51. 3D STRUCTURES OF NANOWIRES

Methods

Nanowire Growth

TEM Characterization

Image Simulations

Result

Crystal Structure

Image Simulations

Discussion

Summary

52. SUPERIOR CONDUCTIVITY OF NANOPARTICLES

Experimental Details

Synthesis of Nanocomposites

Characterization

Results and Discussion

Conclusions

53. STRUCTURAL AND ELECTRONIC PROPERTIES OF ZnO

NANOTUBES

Computational Method

Results and Discussion

Conclusions

54. SYNTHESIS OF NANOCRYSTALLINE CERAMIC POWDERS

Experimental Procedure

Results and Discussion

Nanocrystalline CeO₂ Powders Through Glycine-Nitrate and Citrate-Nitrate Combustion

Auto-Ignition Synthesis of Monophasic BaTi₄O₉ and Ba₂Ti₉O₁₂ Powders

Combustion Synthesis of TbO₂, and MTbO₃ (M = Ba and Sr)

Conclusions

55. NANOCLUSTERS ON POLYMER SURFACES

Organization of Nanoparticles on the Polymer Matrices: Why?

Nanoclusters Organization on Polymers: How?

Electrostatic Organization

Covalent Organization

Vander-Waals Organization

Different Preparation Strategies

Nanocomposites Versus Surface Functionalisation

Selection of Polymers

Selection of Clusters
Metallic Nanoclusters
Semi-conducting Nanoclusters
Characterisation Techniques
Selected Applications
Catalytic Applications
Photovoltaic Applications
Biological Applications
Limitations of Cluster Organization on Polymers
Conclusion

About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

NIIR PROJECT CONSULTANCY SERVICES , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** npcs.india@gmail.com **Website:** NIIR.org

Fri, 26 Apr 2024 18:01:46 +0530