

1. Record Nr.	UNINA9911019905003321
Autore	Goel Sanket
Titolo	Micro Electromechanical Systems (MEMS) : Practical Lab Manual
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2025 ©2025
ISBN	9781394229840 1394229844 9781394229857 1394229852 9781394229864 1394229860
Edizione	[1st ed.]
Descrizione fisica	1 online resource (173 pages)
Collana	IEEE Press Series on Sensors Series
Altri autori (Persone)	KumarSanjeet BhaiyyaManish AmreenKhairunnisa KumarPavar Sai KumarAbhishek
Disciplina	621.381
Soggetti	Microelectromechanical systems Microfluidic devices
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Series Page -- Title Page -- Copyright Page -- Contents -- About the Editor -- List of Contributors -- Preface -- About the Companion Website -- Chapter 1 Multiphysics Simulations on the Effect of Fluidic Concentration Profiles Over Y-Channel andT-Channel Designs -- 1.1 Introduction -- 1.2 Real-Time Applications of This Study -- 1.3 Simulation Section -- 1.3.1 Prerequisites -- 1.3.2 Computer-Aided Designing (CAD) -- 1.3.3 Simulation Parameters -- 1.4 Results and Discussions -- 1.4.1 Model Designing -- 1.4.2 COMSOL Simulations -- 1.5 Conclusion -- References -- Chapter 2 Droplet Generation in T-Junction Microchannel Using Multiphysics Software -- 2.1 Introduction -- 2.1.1 Brief Overview -- 2.2 Simulation Section -- 2.2.1 Prerequisites -- 2.2.2 Model and Geometry Definition

-- 2.2.3 Simulation Parameters -- 2.3 Result and Discussion -- 2.4 Conclusion -- References -- Chapter 3 Cleanroom-Assisted and Cleanroom-Free Photolithography -- 3.1 Introduction -- 3.2 Photolithography Basics, Classification and Applications -- 3.2.1 Cleanroom-Assisted Photolithography -- 3.2.2 Cleanroom-Unassisted Photolithography -- 3.2.3 Cleanroom-Assisted vs. Cleanroom-Unassisted Photolithography -- 3.3 Experimental Section on Designing and Development of Features Using Photolithography -- 3.3.1 Brief Overview -- 3.3.2 Prerequisites -- 3.3.3 Instrumentation and Software -- 3.3.4 Stepwise Photolithography Procedure to Develop a Pattern -- 3.4 Conclusion -- References -- Chapter 4 Additive Manufacturing (3D Printing) -- 4.1 Stereolithography (SLA) Printing of Y-Channeled Microfluidic Chip -- 4.1.1 Introduction -- 4.1.2 Real-Time Applications of This Study -- 4.1.3 Designing Section -- 4.1.3.1 Prerequisites -- 4.1.3.2 Software and Instrumentation -- 4.1.3.3 Designing a Y-Channeled Microfluidic Chip -- 4.1.4 3D Printing Section -- 4.1.4.1 Slicing Operations. -- 4.1.4.2 Cleaning and Curing Operations -- 4.1.5 Conclusion -- 4.2 Fused Deposition Modeling (FDM): Fabrication of Single Electrode Electrochemiluminescence Device -- 4.2.1 Introduction -- 4.2.1.1 Brief Overview -- 4.2.2 Designing Section -- 4.2.2.1 Prerequisites -- 4.2.2.2 Software and Instrumentation -- 4.2.2.3 Fabrication Step -- 4.2.3 Conclusion -- References -- Chapter 5 Laser Processing -- 5.1 CO₂ Laser for Electrochemical Sensor Fabrication -- 5.1.1 Introduction -- 5.1.2 Real-Time Applications of This Study -- 5.1.3 Brief Overview -- 5.1.4 Experimental Section -- 5.1.4.1 Prerequisites -- 5.1.4.2 Materials, Instrumentation, and Software -- 5.1.4.3 Fabrication Steps -- 5.1.5 Conclusion -- 5.2 One-Step Production of Reduced Graphene Oxide from Paper via 450 nm Laser Ablations -- 5.2.1 Introduction -- 5.2.2 Experimentation -- 5.2.2.1 Prerequisites -- 5.2.2.2 Instrumentation and Software -- 5.2.2.3 Design File Generations -- 5.2.3 Production of rGO Patterns -- 5.3 Conclusion -- References -- Chapter 6 Soft Lithography: DLW-Based Microfluidic Device Fabrication -- 6.1 Introduction -- 6.2 Designing Section -- 6.2.1 Prerequisites -- 6.2.2 Instrumentation and Software -- 6.2.3 Step-by-Step Procedure for DLW-Soft Lithography Microfluidic Device Design -- 6.3 Conclusion -- References -- Chapter 7 Electrode Fabrication Techniques -- 7.1 Inkjet Printing Technique: Electrode Fabrication for Advanced Applications -- 7.1.1 Introduction -- 7.1.2 Designing Section -- 7.1.2.1 Prerequisites -- 7.1.2.2 Instrument and Equipment Required -- 7.1.2.3 Designing a Microelectrode Device -- 7.1.3 Dip Trace and Voltera V-One Microfabrication Section -- 7.1.3.1 Gerber Format File Generation -- 7.1.3.2 Voltera V-One Software -- 7.1.4 Conclusion -- 7.2 Screen Printing Technique for Electrochemical Sensor Fabrication -- 7.2.1 Introduction -- 7.2.2 Brief Overview. -- 7.2.3 Experimental Section -- 7.2.3.1 Prerequisites -- 7.2.3.2 Materials, Instrumentation, and Software -- 7.2.3.3 Fabrication Steps -- 7.2.4 Conclusion -- 7.3 Physical Vapor Deposition (PVD) Technique for Electrode Fabrication -- 7.3.1 Introduction -- 7.3.1.1 Physical Vapor Deposition (PVD) -- 7.3.1.2 Gold Electrodes as Biosensors -- 7.3.2 Experimental Details -- 7.3.2.1 Instrument and Equipment Required -- 7.3.2.2 Equipment Setup -- 7.3.2.3 Substrate Preparation -- 7.3.2.4 Deposition Process -- 7.3.2.5 Electrode Fabrication -- 7.3.3 Precautions -- 7.4 Conclusion -- References -- Chapter 8 Morphological Characterization -- 8.1 Morphological Studies with Different Techniques -- 8.1.1 Introduction -- 8.2 Scanning Electron Microscopy -- 8.3 Steps Involved in the Scanning Electron Microscope Characterization -- 8.3.1 Brief Overview -- 8.3.2 Sample

Preparation -- 8.3.3 Instrumentation -- 8.3.4 Results and Conclusion
-- 8.4 X-Ray Diffraction (XRD) -- 8.4.1 Introduction -- 8.4.2 XRD
Setup -- 8.4.3 Sample Preparations and Methodology -- 8.4.3.1 Brief
Overview -- 8.4.3.1 Brief Overview -- 8.4.4 Steps Involved in Sample
Preparation -- 8.4.5 Instrument Setup -- 8.4.6 Data Collection -- 8.4.7
Data Analysis -- 8.4.8 Crystal Structure Determination (if Necessary) --
8.4.9 Data Interpretation -- 8.4.10 Conclusion -- 8.5 Optical LED
Microscope -- 8.5.1 Introduction -- 8.5.2 Sample Preparation --
8.5.2.1 Prerequisites -- 8.5.2.1 Prerequisites -- 8.5.3 Brief Overview --
8.5.4 Principle of Optical Microscope -- 8.5.5 Sample Preparation
and Instrumentation Setup -- 8.5.6 Conclusion -- 8.6 Contact Angle --
8.6.1 Introduction -- 8.6.2 Setup Specifications -- 8.6.3 Biolin
Scientific Theta Lite - Optical Tensiometer -- 8.6.4 Sample Preparations
and Methodology -- 8.6.4.1 Brief Overview -- 8.6.4.1 Brief Overview.
8.6.5 Protocols to Be Followed While Operating the Instrument -- 8.6.6
Conclusions -- References -- Chapter 9 Spectroscopic Characterization
-- 9.1 Introduction -- 9.2 Ultraviolet-Visible (UV-Vis)
Spectrophotometers -- 9.2.1 Steps Involved -- 9.2.2 Conclusion -- 9.3
X-Ray Photoelectron Spectroscopy (XPS) -- 9.3.1 Fundamentals of XPS
-- 9.3.1.1 XPS Instruments Have the Following Components -- 9.3.2
Sample Preparation Steps -- 9.3.2.1 Sample Mounting -- 9.3.3
Experimental Procedure -- 9.3.3.1 Detailed Instructions -- 9.3.4
Conclusion -- 9.4 Raman Spectroscopy -- 9.4.1 Sample Preparation --
9.4.1.1 Prerequisites -- 9.4.2 Experimental Procedure -- 9.4.2.1
Instrumentation Configuration -- 9.4.2.2 Specific Intensity Ranges --
9.4.2.3 Sample Preparation -- 9.4.2.4 Laser Targeting -- 9.4.2.5
Measurement of the Baseline -- 9.4.2.6 Subtraction of Dark Signals --
9.4.2.7 Spectrum Calibration -- 9.4.2.8 Raman Scanning -- 9.4.2.9
Data Analysis -- 9.4.2.10 Data Interpretation -- 9.4.2.11 Data
Representation -- 9.4.2.12 Cleansing -- 9.4.3 Results -- 9.5 Fourier
Transform Infrared (FTIR) Spectroscopy -- 9.5.1 Brief Overview -- 9.5.2
Sampling Techniques in FTIR -- 9.5.3 Sample Preparation -- 9.5.3.1
Solid Samples (Powders and Thin Films) -- 9.5.3.2 Liquid Samples --
9.5.3.3 Gaseous Sample -- 9.5.4 Interpretation of FTIR -- 9.5.5
Conclusion -- References -- Chapter 10 Microfluidic Devices -- 10.1
Electrochemical Detection of Bacteria, Biomarkers, Biochemical,
and Environmental Pollutants -- 10.1.1 Introduction -- 10.1.2
Experimental Section for Detection of Bacteria (*Escherichia coli* (*E. coli*))
-- 10.1.2.1 Brief Overview -- 10.1.2.2 Prerequisites -- 10.1.2.3
Chemicals and Equipment -- 10.1.2.4 Procedure -- 10.1.3
Experimental Section for Detection of Biomarkers (Lactate) -- 10.1.3.1
Brief Overview -- 10.1.3.2 Prerequisites -- 10.1.3.3 Chemicals and
Equipment.
10.1.3.4 Procedure -- 10.1.4 Experimental Section for Detection
of Biochemical Analyte -- 10.1.4.1 Brief Overview -- 10.1.4.2
Prerequisites -- 10.1.4.3 Procedure -- 10.1.4.4 Discussion -- 10.1.5
Experimental Section for Detection of Environmental Pollutants --
10.1.5.1 Brief Overview -- 10.1.5.2 Prerequisites -- 10.1.5.3 Procedure
-- 10.1.6 Conclusion -- 10.2 Microfluidics Integrated
Electrochemiluminescence System for Hydrogen Peroxide Detection --
10.2.1 Introduction -- 10.2.2 Experimental Section -- 10.2.2.1 Brief
Overview -- 10.2.2.2 Prerequisites -- 10.2.2.3 Materials and
Instrumentation -- 10.2.2.4 General Electrochemiluminescence Process
Luminol and Hydrogen Peroxide -- 10.2.2.5 Precautions -- 10.2.3
Conclusion -- 10.3 Development of Microfluidic Chip for
Colorimetric Analysis -- 10.3.1 Introduction -- 10.3.2 Experimentation
-- 10.3.2.1 Brief Overview -- 10.3.2.2 Prerequisites -- 10.3.2.3
Solution Preparation -- 10.3.2.4 Software Required -- 10.3.3

Colorimetric Determination on Microfluidic Chip -- 10.3.4 Conclusions -- 10.4 Development of Disposable and Eco-Friendly PADs as Chemiluminescence Substrates -- 10.4.1 Introduction -- 10.4.2 Real-Time Applications of This Study -- 10.4.3 Experimentation -- 10.4.3.1 Prerequisites -- 10.4.3.2 Software Installations -- 10.4.3.3 Design of Hydrophobic Barriers -- 10.4.4 3D Printing of Hydrophobic Barriers -- 10.4.5 Conclusion -- 10.5 Microfluidic Devices for Polymerase Chain Reaction (PCR) -- 10.5.1 Introduction -- 10.5.2 Prerequisites -- 10.5.3 Software Installations -- 10.5.4 Design and Fabrication of Microfluidic Device -- 10.5.5 Conclusion -- References -- Chapter 11 Wearable Devices -- 11.1 Application of Laser-Induced Graphene in Breath Analysis -- 11.1.1 Introduction -- 11.1.2 Experimentation -- 11.1.2.1 Brief Overview -- 11.1.3 Conclusion. 11.2 Wearable Microfluidic Device for Nucleic Acid Amplification.

Sommario/riassunto

This comprehensive manual provides practical guidance and insights into Microelectromechanical Systems (MEMS), with a focus on microfluidic device design, fabrication techniques, and simulation methodologies. Edited by Sanket Goel, the book explores various advanced topics such as additive manufacturing, laser processing, electrode fabrication, and spectroscopic analysis, supported by real-world applications. It includes contributions from multiple experts, offering detailed procedures, prerequisites, and experimental setups for designing and fabricating MEMS devices. Designed for researchers, engineers, and professionals working in sensor technology and microsystems, the manual serves as a valuable resource for mastering modern MEMS practices and methodologies.
