

1. Record Nr.	UNINA9910810163103321
Autore	Karmakar Nemai Chandra <1963->
Titolo	Chipless RFID sensors / / Nemai Chandra Karmakar, Emran Md Amin, Jhantu Kumar Saha
Pubbl/distr/stampa	Hoboken, New Jersey : , : Wiley, , [2016] [Piscataway, New Jersey] : , : IEEE Xplore, , [2016]
ISBN	1-119-07811-3 1-119-07813-X
Descrizione fisica	1 online resource (274 pages)
Classificazione	TEC061000TEC034000
Disciplina	621.3841/92
Soggetti	Radio frequency identification systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	-- Preface xv -- Acknowledgments xxi -- Abbreviations xxiii -- Symbols xxv -- 1 Introduction 1 -- 1.1 Tracking ID Technology, 1 -- 1.1.1 Barcoding, 1 -- 1.1.2 Radio-Frequency Identification, 3 -- 1.1.3 Chipless RFID, 4 -- 1.1.4 Chipless RFID Sensors, 4 -- 1.2 Chipless RFID Sensor System, 6 -- 1.3 Proposed Chipless RFID Sensor, 7 -- 1.4 Chapter Overview, 7 -- 1.4.1 Chapter 1: Introduction, 7 -- 1.4.2 Chapter 2: Literature Review, 7 -- 1.4.3 Chapter 3: Passive Microwave Designs, 8 -- 1.4.4 Chapter 4: Smart Materials for Chipless RFID Sensors, 9 -- 1.4.5 Chapter 5: Characterization of Smart Materials, 9 -- 1.4.6 Chapter 6: Chipless RFID Sensor for Noninvasive PD Detection and Localization, 9 -- 1.4.7 Chapter 7: Chipless RFID Sensor for Real-Time Environment Monitoring, 10 -- 1.4.8 Chapter 8: Chipless RFID Temperature Memory and Multiparameter Sensor, 10 -- 1.4.9 Chapter 9: Nanofabrication Techniques for Chipless RFID Sensor, 10 -- 1.4.10 Chapter 10: Chipless RFID Reader Architecture, 10 -- 1.4.11 Chapter 11: Case Studies, 11 -- References, 11 -- 2 Literature Review 13 -- 2.1 Introduction, 13 -- 2.2 Traditional RFID Sensors, 14 -- 2.2.1 Active RFID Sensors, 14 -- 2.2.2 Passive RFID Sensors, 15 -- 2.2.3 Low-Cost Chipless RFID Sensors, 16 -- 2.3 Challenges and Limitations of Current Chipless RFID Sensors, 21 -- 2.3.1 Fully Printable, 21 -- 2.3.2 Smart Sensing Materials, 22 -- 2.3.3 Multiple Parameter Sensing, 22 -- 2.3.4 Chipless RFID Sensor Systems, 22 -- 2.3.5 Applications, 22 -- 2.4

Motivation for a Novel Chipless RFID Sensor, 23 -- 2.5 Proposed Chipless RFID Sensor, 23 -- 2.5.1 Noninvasive PD Detection and Localization, 23 -- 2.5.2 Real-Time Environment Monitoring, 24 -- 2.5.3 Nonvolatile Memory Sensor for Event Detection, 24 -- 2.5.4 Single-Node Multiparameter Chipless RFID Sensor, 24 -- 2.6 Conclusion, 24 -- References, 25 -- 3 Passive Microwave Design 29 -- 3.1 Introduction, 29 -- 3.2 Chapter Overview, 29 -- 3.3 Theory, 31 -- 3.3.1 Passive Microwave Components, 31. 3.3.2 Integrated Chipless RFID Sensor, 39 -- 3.4 Design, 40 -- 3.4.1 Tri-Step SIR, 40 -- 3.4.2 Semicircular Patch Antenna, 43 -- 3.4.3 Cascaded Multiresonator-Based Chipless RFID Sensor, 43 -- 3.4.4 Multislot Patch Resonator, 44 -- 3.4.5 ELC Resonator for RF Sensing, 48 -- 3.4.6 Backscatterer-Based Chipless RFID Tag Sensor, 49 -- 3.5 Simulation and Measured Results, 54 -- 3.5.1 Tri-Step SIR, 54 -- 3.5.2 Semicircular Patch Antenna, 55 -- 3.5.3 Cascaded Multiresonator-Based Chipless RFID Sensor, 56 -- 3.5.4 Multislot Patch Resonator, 56 -- 3.5.5 ELC Resonator, 62 -- 3.5.6 Backscatterer-Based Chipless RFID Tag Sensor, 62 -- 3.6 Conclusion, 65 -- References, 67 -- 4 Smart Materials for Chipless RFID Sensors 69 -- 4.1 Introduction, 69 -- 4.2 Sensing Materials, 70 -- 4.2.1 Smart Materials, 71 -- 4.2.2 Classification of Smart Materials for RF Sensing, 72 -- 4.3 Temperature Sensing Materials, 73 -- 4.3.1 Phenanthrene, 73 -- 4.3.2 Ionic Plastic Crystal, 73 -- 4.3.3 Nanostructured Metal Oxide, 76 -- 4.4 Humidity Sensing Materials, 77 -- 4.4.1 Kapton, 77 -- 4.4.2 Polyvinyl Alcohol, 78 -- 4.5 pH Sensing Materials, 78 -- 4.6 Gas Sensing Materials, 79 -- 4.7 Strain and Crack Sensing Materials, 80 -- 4.8 Light Sensing Materials, 80 -- 4.8.1 SIR Loaded with CdS Photoresistor, 81 -- 4.9 Other Potentials Smart Materials for RF Sensing, 82 -- 4.9.1 Graphene, 83 -- 4.9.2 Nanowires, 85 -- 4.9.3 Nanoparticles, 85 -- 4.9.4 Nanocomposites, 86 -- 4.10 Discussion, 88 -- 4.11 Conclusion, 93 -- References, 94 -- 5 Characterization of Smart Materials 99 -- 5.1 Introduction, 99 -- 5.2 Characterization of Materials for Microwave Sensing, 101 -- 5.3 X-Ray Diffraction, 101 -- 5.4 Raman Scattering Spectroscopy, 102 -- 5.5 Secondary Ion Mass Spectrometer, 103 -- 5.6 Transmission Electron Microscopy, 104 -- 5.7 Scanning Electron Microscope, 104 -- 5.8 Atomic Force Microscopy, 105 -- 5.9 Infrared Spectroscopy (Fourier Transform Infrared Reflection), 106 -- 5.10 Spectroscopic Ellipsometry, 106 -- 5.10.1 Basic Steps for a Model-Based Analysis, 111. 5.10.2 Layered Optical Model, 111 -- 5.10.3 Optical Model for Surface Roughness, 112 -- 5.10.4 Approximation of Surface Roughness As an Oxide Layer, 112 -- 5.10.5 Optical Model for Index Gradients, 112 -- 5.10.6 Procedure for an Ellipsometric Modeling, 113 -- 5.10.7 Regression, 113 -- 5.10.8 Dielectric Film, 114 -- 5.10.9 Mixed or Composite Materials, 114 -- 5.10.10 Accuracy and Precision of SE Experiments, 114 -- 5.11 UV / Visible Spectrophotometers, 115 -- 5.12 Electrical Conductivity Measurement, 115 -- 5.13 Microwave Characterization (Scattering Parameters - Complex Permittivity, Dielectric Loss, and Reflection Loss) for Sensing Materials, 117 -- 5.13.1 Basic Microwave-Material Interaction Aspects, 118 -- 5.13.2 Methods of Measurement of Dielectric Properties, 119 -- 5.14 Discussion on Characterization of Smart Materials, 120 -- 5.15 Conclusion, 121 -- References, 123 -- 6 Chipless RFID Sensor for Noninvasive PD Detection and Localization 125 -- 6.1 Introduction, 125 -- 6.1.1 Radiometric PD Detection, 127 -- 6.2 Theory, 128 -- 6.2.1 Proposed PD Sensor, 128 -- 6.2.2 PD Sensor System Overview, 129 -- 6.2.3 Simultaneous PD Detection, 130 -- 6.3 PD Localization Using Cascaded Multiresonator-Based Sensor, 133 -- 6.3.1 PD Sensor,

133 -- 6.3.2 Experimentation with PD Signal, 133 -- 6.3.3 Data Encoding in PD Signal, 134 -- 6.4 Simultaneous PD Detection, 138 -- 6.4.1 Time / Frequency Analysis, 138 -- 6.4.2 Effect of Time and Frequency Resolution, 138 -- 6.4.3 Simultaneous PD Detection Incorporating Time Delay, 141 -- 6.5 Conclusion, 143 -- References, 145 -- 7 Chipless RFID Sensor for Real-Time Environment Monitoring 149 -- 7.1 Introduction, 149 -- 7.2 Phase 1. Humidity Sensing Polymer Characterization and Sensitivity Analysis, 149 -- 7.2.1 Theory of Dielectric Sensor, 149 -- 7.2.2 Characterization of Humidity Sensing Polymers, 151 -- 7.2.3 Sensitivity Curve and Comparative Study, 156 -- 7.3 Phase 2. Chipless RFID Humidity Sensor, 161 -- 7.3.1 Backscatterer-Based Chipless RFID Humidity Sensor, 161. 7.3.2 Experimentation and Results, 162 -- 7.3.3 Calibration Curve for Humidity Sensor, 163 -- 7.3.4 Hysteresis Analysis, 165 -- 7.4 Conclusion, 168 -- References, 169 -- 8 Chipless RFID Temperature Memory and Multiparameter Sensor 171 -- 8.1 Introduction, 171 -- 8.2 Phase 1: Chipless RFID Memory Sensor, 173 -- 8.2.1 Theory, 173 -- 8.2.2 Design of Memory Sensor with ELC Resonator, 174 -- 8.2.3 Experimentation for Chipless RFID Memory Sensor, 175 -- 8.3 Phase 2: Chipless RFID Multiparameter Sensor, 178 -- 8.3.1 Theory, 178 -- 8.3.2 Design, 179 -- 8.3.3 Experimentation for Multiple Parameter Sensing, 180 -- 8.3.4 Practical Challenges of Multiparameter Chipless Sensors, 183 -- 8.4 Conclusion, 183 -- References, 184 -- 9 Nanofabrication Techniques for Chipless RFID Sensors 187 -- 9.1 Chapter Overview, 187 -- 9.2 Fabrication Techniques, 188 -- 9.2.1 Introduction, 188 -- 9.2.2 Classification of Fabrication Techniques, 188 -- 9.3 Electrodeposition, 189 -- 9.4 Physical Vapor Deposition, 189 -- 9.4.1 Thermal Evaporation, 190 -- 9.4.2 Sputtering, 190 -- 9.4.3 Molecular Beam Epitaxy, 191 -- 9.5 Wet Chemical Synthesis, 192 -- 9.6 Plasma Processing, 193 -- 9.7 Etching, 194 -- 9.8 Laser Processing, 195 -- 9.9 Lithography, 196 -- 9.9.1 Photolithography, 196 -- 9.9.2 Electron beam lithography, 198 -- 9.9.3 Ion beam lithography, 200 -- 9.9.4 Nanoimprint lithography (NIL)/Hot Embossing, 201 -- 9.9.5 Thermal Nanoimprint Lithography, 201 -- 9.9.6 UV-Based Nanoimprint Lithography, 202 -- 9.9.7 Reverse Contact UVNIL / RUVNIL, 203 -- 9.10 Surface or Bulk Micromachining, 203 -- 9.11 Printing Techniques, 204 -- 9.11.1 Screen Printing, 205 -- 9.11.2 Inkjet Printing, 207 -- 9.11.3 Laser Printing, 209 -- 9.12 Discussion on Nanofabrication Techniques, 209 -- 9.13 Chipless RFID Sensors on Flexible Substrates, 213 -- 9.14 Conclusion, 213 -- References, 215 -- 10 Chipless RFID Reader Architecture 217 -- 10.1 Introduction, 217 -- 10.2 Reader Architecture, 217 -- 10.2.1 RF Module, 218 -- 10.2.2 Digital Module, 219. 10.3 Operational Flowchart of a Chipless RFID Reader, 221 -- 10.3.1 Reader Calibration, 221 -- 10.3.2 Real-Time Sensor Data Decoding, 223 -- 10.3.3 Tag ID Decoding, 223 -- 10.4 Conclusion, 223 -- References, 224 -- 11 Case Studies 225 -- 11.1 Introduction, 225 -- 11.2 Food Safety, 226 -- 11.3 Health, 229 -- 11.4 Emergency Services, 232 -- 11.5 Smart Home, 234 -- 11.6 Agricultural Industry, 234 -- 11.7 Infrastructure Condition Monitoring, 236 -- 11.8 Transportation and Logistics, 236 -- 11.9 Authentication and Security, 236 -- 11.9.1 Solution, 237 -- 11.10 Power Industry, 238 -- 11.11 Conclusion and Original Contributions, 239 -- References, 241 -- Index 243.

Sommario/riassunto

"Providing a classification of smart materials based on sensing physical parameters (i.e. humidity, temperature, pH, gas, strain, light, etc.)"--