Contents

PREFACE ix

CHAPTER 1. FABRICATION OF MICROELECTRODES USING ORIGINAL "SOFT LITHOGRAPHY" PROCESSES 1
Stéphane COTTE, Abdellatif BARAKET, François BESSUEILLE, Stéphane GOUT, Nourdin YAAKOUBI, Didier LEONARD and Abdelhamid ERRACHID

1.1. Introduction. 1
1.2. Materials and methods 2
1.2.1. Selective peeling 2
1.2.2. Localized passivation 3
1.3. Selective peeling process development and results 4
1.4. Localized passivation process development and results. 5
1.5. Conclusions. 8
1.6. Bibliography 8

CHAPTER 2. LOVE WAVE CHARACTERIZATION OF MESOPOROUS TITANIA FILMS 11
Laurianne BLANC, Grégory TORTISSIER, Cédric BOISSIÈRE, Corinne DEJOUS and Dominique REBIÈRE

2.1. Introduction. 11
2.2. Love wave platform. 12
2.3. Mesoporous materials. 13
2.4. Environmental ellipsometric porosimetry 15
2.4.1. Measurement principle. 15
2.4.2. Sorption isotherm. 16
2.5. Experimental set-up 17
2.5.1. Mesoporous sensitive layer deposition 17

2.5.2. Test bench 17
2.5.3. Results 19
2.6. Numerical simulations 19
2.6.1. Love wave propagation numerical model. 19
2.6.2. Simulation of sensor frequency response 23
2.6.3. Extraction of shear modulus of the TiO_2 film 25
2.7. Causes of mechanical stress induced by humidity sorption. 27
2.7.1. Capillary contraction 27
2.7.2. Swelling and residual sol–gel stress 28
2.8. Conclusions. 30
2.9. Bibliography 31

CHAPTER 3. IMMUNOSENSING WITH SURFACE ACOUSTIC WAVE SENSORS: TOWARD HIGHLY SENSITIVE AND SELECTIVE IMPROVED PIEZOELECTRIC BIOSENSORS. 35
Najla FOURATI and Chouki ZERROUKI

3.1. Introduction. 35
3.2. SAW sensors and measurement systems. 36
3.2.1. SAW transducers 36
3.2.2. Measurement instrumentation 38
3.2.3. An example of SAW device and conditioning system 40
3.2.4. SAW immunosensors' potential and their possible improvement 42
3.3. Immunosensing applications to evaluate SAW device performances 45
3.4. Survey of clinical applications of SAW immunosensor systems 54
3.4.1. Cardiac biomarker detection 55
3.4.2. Bacterial detection 57
3.4.3. Cell detection 57
3.4.4. Virus detection 60
3.4.5. Cocaine detection 61
3.5. Conclusion 62
3.6. Bibliography 62

CHAPTER 4. AC NANOCALORIMETER ON SELF-STANDING PARYLENE MEMBRANE 69
Emmanuel ANDRE, Aitor FERNANDEZ LOPEANDIA, Jean-Luc GARDEN, Dominique GIVORD and Olivier BOURGEOIS

4.1. Introduction. 69
4.2. Advantage of this type of microdevice 69

4.2.1. The samples 70
4.2.2. Measurement method: the AC calorimetry 70
4.3. Nanocalorimeter for measuring nano objects 71
4.3.1. The parylene membrane 72
4.3.2. Thermometer and heater in NbN_x 73
4.3.3. Manufacturing 74
4.3.4. Sample placement 77
4.4. Device performances 77
4.4.1. Temperature calibration 77
4.4.2. Thermal conductance of the empty cell 78
4.4.3. Dynamic characterization of an empty calorimetric cell 79
4.4.4. Heat capacity of an empty calorimetric cell 80
4.4.5. Heat capacity of a $GdAl_2$ microcrystal 81
4.5. Conclusion 83
4.6. Acknowledgments 83
4.7. Bibliography 83

CHAPTER 5. OSCILLATORY FAILURE DETECTION IN THE FLIGHT CONTROL SYSTEM OF A CIVIL AIRCRAFT USING SOFT SENSORS 85
Do Hieu TRINH, Benoît MARX, Philippe GOUPIL and José RAGOT

5.1. Introduction 85
5.2. Modeling of the studied system 86
5.3. Design of a soft sensor for the oscillatory failure detection 88
5.4. Fault detection by standard deviation test 90
5.4.1. Residual generation 90
5.4.2. Generation of failure indicators 93
5.4.3. Failure detection by standard deviation test 94
5.4.4. Discussion on failure detection by standard deviation test 96
5.5. Fault detection by correlation test 97
5.5.1. Pattern generation 98
5.5.2. Failure indicator generation and fault detection by correlation test 100
5.5.3. Discussion on the failure detection by correlation test 103
5.6. Conclusion 104
5.7. Acknowledgments 104
5.8. Bibliography 104

CHAPTER 6. EMBEDDED SENSORS FOR THE ANALYSIS OF DRIVERS' BEHAVIOR 107
Patrick PLAINCHAULT, Sébastien AUBIN, Patrice BRIAND, Jean-Michel AUBERLET and Thierry BOSCH

6.1. Introduction 107
6.2. Trajectories' observatory 109
6.2.1. Trajectory 110
6.2.2. The measurement 110
6.2.3. Bragg fibers 110
6.2.4. Resistive sensors 112
6.2.5. Electromagnetic loops 114
6.3. The sensors' network 115
6.3.1. Spacing between the sensors 115
6.3.2. The sensor network's display 116
6.4. Weather conditions 117
6.5. Analysis processing 117
6.5.1. Analysis before installation 118
6.5.2. Analysis of the development's aftermath 120
6.6. Conclusion 122
6.7. Acknowledgments 122
6.8. Bibliography 123

CHATPER 7. LARGE DEFORMABLE ANTENNAS 125
Sylvain GIRARD, Hervé GILLES, Philippe LEPRINCE, Olivier CLOUARD, Mourad CHTIOUI, Isabelle BARBEREAU, Guillaume LESUEUR and Thomas MERLET

7.1. Introduction 125
7.2. Mechanical analysis 128
7.3. Optical instrumentation for deformable antennas 128
7.3.1. Principle of the optical sensor based on fiber ribbons 132
7.3.2. Principle of optical sensor based on polarization rotation 135
7.4. Experience on a planar structure 139
7.5. Conclusion 145
7.6. Acknowledgments 146
7.7. Bibliography 146

LIST OF AUTHORS 149

INDEX 153