Contents

1. Introduction 1
1.1 State of the art and motivation 1
1.1.1 Polymer optical fibers 1
1.1.2 Polymer fiber gratings 4
1.2 Objectives 6
1.3 Structure of the thesis 7
1.4 References 8
2. Optimization of fabrication process 13
2.1 Bragg gratings inscription in POF with a single pulse 13
2.1.1 Introduction 13
2.1.2 Experimental setup 14
2.1.3 Results and discussion 15
2.1.4 Conclusion 18
2.2 Bragg gratings inscription in POFs made of different materials 19
2.2.1 Introduction 19
2.2.2 Experimental results 20
2.2.3 Results and discussion 22
2.2.4 Conclusion 25
2.3 Bragg gratings inscription in TS doped PMMA POF 27
2.3.1 Introduction 27
2.3.2 Bragg grating fabrication 27
2.3.3 Bragg grating performance 30
2.3.4 Conclusion 32
2.4 Bragg grating inscription with low pulse energy in doped mPOF 33
2.4.1 Introduction 33
2.4.2 Bragg grating fabrication 34
2.4.3 Conclusion 38

2.5 Bragg grating inscription in CYTOP POF 39
2.5.1 Introduction 39
2.5.2 Bragg grating fabrication 40
2.5.3 Temperature and strain characterization 41
2.5.4 Discussion and Conclusion 43
2.6 References 44
3. Fabrication of different types of gratings **49**
3.1 Moiré phase-shifted fiber Bragg gratings 49
3.1.1 Introduction 49
3.1.2 Phase-shifted Moiré FBG fabrication 50
3.1.3 Strain and temperature characterization 52
3.1.4 Conclusion 53
3.2 Tunable chirped mPOF Bragg gratings 55
3.2.1 Introduction 55
3.2.2 Basics of chirped Bragg grating using tapered fibers 55
3.2.3 Experimental chirped fiber Bragg grating with etched technology 56
3.2.4 Strain and temperature response of chirped fiber Bragg grating 59
3.2.5 Conclusion 62
3.3 Hot water-assisted fabrication of Chirped mPOF Bragg grating 64
3.3.1 Introduction 64
3.3.2 Polymer optical fiber Bragg grating fabrication 65
3.3.3 Gradient thermal annealing 65
3.3.4 Characterization of POF chirped FBG 69
3.3.5 Conclusion 71
3.4 Long period gratings 72
3.4.1 Introduction 72
3.4.2 Long period grating fabrication 72
3.4.3 Strain and temperature characterization 75
3.4.4 Conclusion 78
3.5 References 79
4. Novel applications of polymer fiber gratings **85**
4.1 Strain sensing 85

4.1.1 Introduction 85
4.1.2 Strain response 86
4.1.3 Temperature response 87
4.1.4 Humidity response 89
4.1.5 Conclusion 91
4.2 Thermal profile detection 92
4.2.1 Introduction 92
4.2.2 mPOF CFBG inscription and interrogation 93
4.2.3 Experiment 96
4.2.4 Conclusion 100
4.3 Dispersion compensation 101
4.3.1 Introduction 101
4.3.2 Grating device fabrication 101
4.3.3 Dispersion measurement 102
4.3.4 Conclusion 105
4.4 References 106
5. General discussion of the results 111
5.1 Gratings fabrication 111
5.2 Different types of gratings 111
5.3 Gratings applications 113
5.4 References 115
6. Conclusions and future research lines 117
6.1 Conclusions 117
6.1.1 Gratings fabrication 117
6.1.2 Devices and applications 118
6.2 Future research lines 119
Annex: List of publications 120
A.1 Journal publications included in the compendium 120
A.2 Journal and conference publications related but not included 121