

## Table of contents

Abstract.....	v
Zusammenfassung.....	vii
1 Introduction and aim of the work.....	1
1.1 Motivation.....	1
1.2 Definitions.....	2
1.2.1 Microfluidics.....	2
1.2.2 "Biochips".....	3
1.2.3 Materials.....	4
1.2.4 Markets.....	5
1.3 Aim and proceeding.....	6
2 Microfluidic functionalities in a platform.....	9
2.1 Platform requirements.....	9
2.2 Fluidic functionalities.....	10
2.3 Reduced microfluidic functionality set.....	12
2.3.1 Criteria.....	12
2.3.2 Application.....	12
2.3.3 Summary.....	14
3 State of the art.....	17
3.1 Components.....	17
3.1.1 Transport.....	17
3.1.2 Quantification.....	27
3.1.3 Modification.....	30
3.1.4 Summary.....	33
3.2 Existing platform processes.....	34
3.2.1 Fluidic platforms.....	34
3.2.2 Platform processes.....	38
3.2.3 Conclusion.....	43
4 Process flow development.....	45
4.1 Aim.....	45
4.2 General approach to process development.....	46
4.3 Application to fluidic elements.....	49
4.3.1 Procedure.....	49
4.3.2 Concepts for the basic set of fluidic functionalities.....	50
4.4 The Twin Epipoly Process.....	56
4.4.1 Silicon wafer processing.....	56
4.4.2 Glass wafer processing.....	62
4.4.3 Packaging.....	65

# The Twin Epipoly Process

4.5 Summary.....	66
5 Verification of the fluidic functionality.....	67
5.1 Interfacing setup for the demonstrator devices.....	67
5.1.1 Specification.....	67
5.1.2 Implementation.....	69
5.2 Micropump.....	72
5.2.1 Realization: design, layout and process.....	72
5.2.2 Characterization.....	76
5.2.3 Conclusion micropump.....	85
5.3 Thermal element, flow sensor.....	86
5.3.1 Design and layout.....	86
5.3.2 Process.....	89
5.3.3 Characterization.....	92
5.3.4 Combination of micropump and flow sensor.....	96
5.3.5 Conclusion flow sensor.....	97
5.4 Micromixer.....	98
5.4.1 Design and numerical simulation.....	98
5.4.2 Process.....	109
5.4.3 Characterization.....	110
5.4.4 Conclusion micromixer.....	121
6 Summary and outlook.....	123
6.1 Summary.....	123
6.2 Conclusions.....	124
6.3 Outlook.....	127
Acknowledgments.....	131
References.....	133
Publications and patents.....	145
Appendix A: Layout rules.....	147
A.1 Feature sizes.....	147
A.2 Feature distances.....	147
Appendix B: Demonstrator layout.....	149
B.1 Micropump.....	149
B.2 Flow sensor.....	152
B.3 Mixer.....	153
Curriculum vitae.....	155