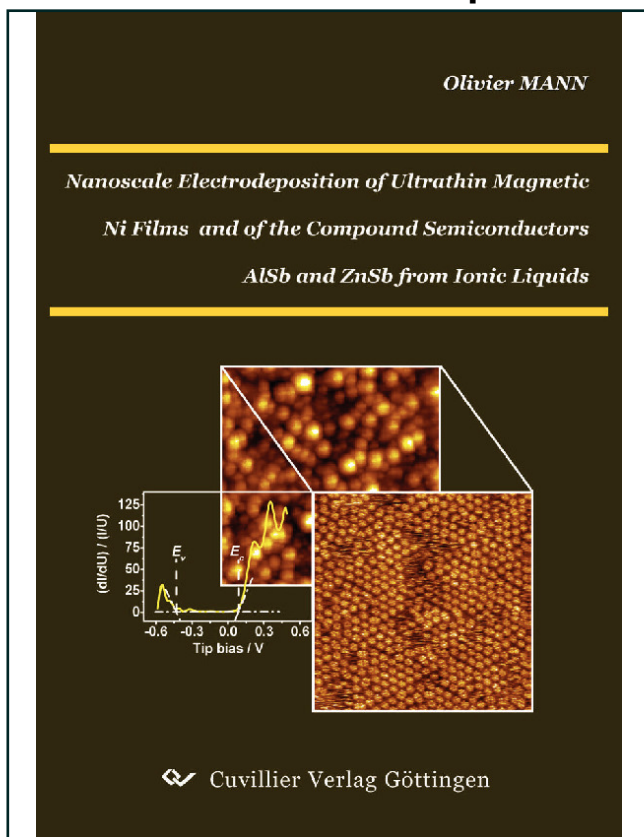




Olivier Mann (Autor)

Nanoscale Electrodeposition of Ultrathin Magnetic Ni Films and of the Compound Semiconductors AISb and ZnSb from Ionic Liquids



<https://cuvillier.de/de/shop/publications/1558>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentzsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>

Contents

Zusammenfassung	5
Abstract	7
1 Introduction	9
2 Theoretical Background	13
2.1 Scanning tunneling microscopy (STM)	13
2.1.1 Tunnel effect	13
2.1.2 Tip-surface interaction model	17
2.1.3 Scanning tunneling spectroscopy	20
2.2 Electron Spectroscopy	23
2.3 Electrochemical methods	24
2.3.1 Cyclic voltammetry	24
2.3.2 Chronoamperometry	28
3 Experimental details and data analysis	35
3.1 Electrolytes preparation	36
3.2 Gold substrate preparation	39
3.3 STM tip preparation	40
3.4 The electrochemical scanning tunneling microscope	41
3.4.1 Room temperature EC-STM	41
3.4.2 Elevated temperature EC-STM	45
3.5 Experimental procedure and data analysis	46

3.5.1	Experiment preparation	46
3.5.2	Electrochemical measurement	46
3.5.3	STM measurement	47
3.5.4	STS measurement	48
3.6	Possible sources of error	49
4	Electrocrystallization of distinct Ni nanostructures	53
4.1	Introduction	53
4.2	Voltammetric study	54
4.3	Adsorption of AlCl_4^-	56
4.4	Underpotential deposition of Ni	58
4.5	Overpotential deposition of Ni	60
4.6	Chronoamperometry investigations	65
5	Microscopic and electronic structure of Sb and AlSb	71
5.1	Introduction	71
5.2	Cyclic voltammetry investigation	73
5.3	Underpotential deposition of Sb	75
5.4	Surface alloying	78
5.5	Overpotential deposition of Sb	80
5.6	Electrocrystallization of the stoichiometric compound semiconductor AlSb	83
5.7	Electrodeposition off of stoichiometric AlSb	85
6	Microscopic and electronic structure of Sb and ZnSb	89
6.1	Introduction	89
6.2	Cyclic voltammetry investigation	90
6.3	Adsorption of ZnCl_3^-	92
6.4	Underpotential deposition of Sb	95
6.5	Overpotential deposition of Sb	98
6.6	Electrocrystallization of the compound semiconductor ZnSb	99
6.7	Electrodeposition off of stoichiometric ZnSb	100

7 Discussion	103
7.1 UPD in different electrolytes: A comparison	103
7.2 Three-dimensional electrocrystallization of Ni	104
7.2.1 Nucleation and growth on a foreign and native substrate . . .	104
7.2.2 Magnetic behaviour of the elongated Ni clusters	107
7.3 Compound semiconductors and their respective doping	109
7.3.1 Doping of semiconductors: A simple model approach	109
7.3.2 Comparison with experimental results	114
7.3.3 Theoretical and experimental uncertainties	116
8 Appendix: Phase Diagrams	119
Manufacturer list	123
Acknowledgments	137
Publications	139
Curriculum vitae	141