

Contents

1. Introduction	1
1.1. Oxidation of Mg – from the past to today	1
1.2. Quantitative analysis of thin oxide layers with X-ray photoelectron spectroscopy	3
1.3. The scope of this thesis	7

Part I

2. Quantitative analysis of the plasmon loss intensities in x-ray photoelectron spectra of magnesium.	8
Abstract	8
2.1. Introduction	9
2.2. Experimental	10
2.3. Calculation of the Mg 2p spectrum	10
2.4. Results and discussion	14
2.5. Conclusions	17
3. Determination of the intrinsic bulk and surface plasmon intensity of XPS spectra of magnesium.	18
Abstract	18
3.1. Introduction	19
3.2. Theoretical background	21
3.2.1. Alternative method for determination of α and β	23
3.3. Experimental	24
3.3.1. Base material and sample preparation	24
3.3.2. Oxidation experiments	24
3.3.3. XPS measurements	25
3.4. Data evaluation	26
3.5. Results and discussion	31
3.6. Conclusions	44

Part II

4. The initial oxidation of magnesium.	46
Abstract	46
4.1. Introduction	47
4.2. Experimental	48
4.2.1. Specimen preparation	48
4.2.2. Oxidation experiments	51
4.2.3. XPS measurements	51
4.2.4. Ellipsometry	53
4.2.5. High resolution elastic recoil detection analysis (HERDA)	54
4.2.6. Other techniques	55
4.3. Data evaluation	55
4.3.1. XPS	55
4.3.2. Ellipsometry	61
4.3.3. HERDA	67
4.4. Results and discussion	69
4.4.1. Oxide thickness and growth	69
4.4.2. Oxide composition	78
4.4.3. The oxidation state of magnesium; position and shape of the oxidic Mg 2p peak	88
4.4.4. Band gap of the oxide	95
4.5. Analysis of the oxidation kinetics	99
4.5.1. Theoretical Background	99
4.5.2. Fit procedure and results	100
4.6. Summary	107
Appendix	109
5. Zusammenfassung	111
5.1. Teil I	111
5.1.1. Kapitel 2	112
5.1.2. Kapitel 3	113
5.2. Teil II	116
5.2.1. Kapitel 4	116

References	122
Curriculum Vitae	127
Danksagung	128

