Contents

1. Introduction 1
2. Short summary of deposition methods 5
3. Fundamental electrochemical principles and measurements 10
3.1. Electrochemical series of metais 12
3.2. E-pH diagrams 16
3.3. Electrochemical measurement of corrosion 17
3.4. Potentiodynamic polarisation curve 20
3.5. Corrosion of coated systems 22
4. Corrosion behaviour of TiN coatings 24
4.1. Corrosion behaviour of TiN coatings in dependence of process parameters 24
4.1.1. The influence of coating thickness 24
4.1.2. The influence of interlayers 28
4.1.3. The influence of partial pressure of nitrogen 33
4.1.4. The influence of substrate temperature 34
4.1.5. The influence of substrate 37
4.2. Electrochemical testing of porosjty 42
4.2.1. Multicycling voltammetry 42
4.2.2. Impedance method 44
4.2.3. Coulometric method 48
4.3. Comparison of the corrosion properties of TiN prepared by different methods 51
4.3.1. PVD methods 51
4.3.2. PVD -ion implantation 55
4.3.3. PVD- CVD methods 59
5. Corrosion behaviour of other hard coatings 61
5.1. Corrosion behaviour of CrN and ZrN coatings 61
5.2. Corrosion behaviour of ternary TiN-based coatjngs 64
5.2.1. (Ti,AI)N coatings 65
5.2.2. (Ti,B)N coatings 67
5.2.3. (Ti,Cr)N coatings 67
5.2.4. (Ti,Zr)N coatings 70
6. Combined electrochemical and surface analytical studies 71
6.1. TiN coatings 71
6.1.1. Combined polarization and surface analytical studies 71
6.1.2. Capacitance measurements 81
6.1.3. Photoelectrochemical measurements 83
6.2. CrN and ZrN coatings 86
7. Concluding remarks 100
8. Literature 102