Contents

Abstract (Zusammenfassung)……...1

Chapter 1 Introduction.……..…3

Chapter 2 Experiment…….……...7

2.1 UHV chamber ……...7

2.2 Experimental details……..……9

2.2.1 Thermal desorption spectroscopy (TDS).……9

2.2.2 Auger electron spectroscopy (AES)……..……..……10

2.2.3 Low-energy electron diffraction (LEED)..……..11

2.2.3.1 Structure analysis by measuring and computing I/E curves.……...11

Chapter 3 Structure of the Ru(0001)-(2×2)-3O phase……..15

3.1 Adsorption of oxygen on Ru(0001) -Summary of previous studies…..……..……..……..…..15

3.2 Motivation to studies on the Ru(0001)-(2×2)-3O phase…...18

3.3 Preparation of the Ru(0001)-(2×2)-3O phase……...20

3.4 Structure determination of the Ru(0001)-(2×2)-3O surface by LEED I/E analysis……..22

3.5 CO adsorption on the Ru(0001)-(2×2)-3O surface ….....26

3.5.1 CO adsorption on O-precovered Ru(0001)……...26

3.5.2 Results for CO adsorption on the Ru(0001)-(2×2)-3O phase…….……....28

Chapter 4 CO oxidation over O-rich phases on Ru(0001)…....30

4.1 Motivation.…….....30

4.2 Preparation of O-rich phases on Ru(0001)……..…….....33

4.3 O-rich phases prepared by O_2 exposures at 600 K–800 K.34

4.4 CO adsorption on O-rich phases over Ru(0001)……..39

4.5 Structure analysis for the oxide islands by LEED I/E analysis……...45

4.6 Determination of the adsorption geometry for CO on RuO_2(110)/Ru(0001)…….……...52

4.7 N_2 adsorption on RuO_2(110)/Ru(0001)…….....57

4.8 Weakly bound oxygen on RuO_2(110)/Ru(0001)…….....64

4.9 O-rich phases without oxide formation.…….....74

Chapter 5 CO oxidation over O-rich phases on Ru(10 $\bar{1}$ 0).....81
5.1 Motivation.....81
5.2 Reactivity of O-rich phases on Ru(10$\bar{1}$0) for CO oxidation.....83
5.3 O-rich phases prepared at 600 K.....86
5.4 Formation of different oxide structures at various preparation temperatures.....89
5.5 Adsorption of CO on (1×1)-RuO_2(100)/Ru(10$\bar{1}$0).....90
5.6 Atomic surface structure of (1×1)-RuO_2(100)/Ru(10$\bar{1}$0).....92
5.7 Adsorption of CO on c(2×2)-RuO_2(100)/Ru(10$\bar{1}$0).....98

Chapter 6 CO oxidation on RuO_2(101).....100
6.1 Introduction.....100
6.2 Preparation of RuO_2(101).....100
6.3 CO adsorption on RuO_2(101).....102
6.4 Reactivity of RuO_2(101) for CO oxidation.....105

Chapter 7 Conclusion.....107

References.....110

Acronyms.....116

Acknowledgement.....117

Curriculum vitae.....118