

Electronic properties of semiconductor surfaces and metal/semiconductor interfaces

Inaugural-Dissertation
zur Erlangung der Doktorwürde
am Fachbereich Physik
der Freien Universität Berlin

vorgelegt von
Massimo Tallarida



Berlin, Mai 2005

Arbeit eingereicht am: 24 Mai 2005

Tag der Disputation: 27 Juni 2005

1. Gutachter: Prof. K. Horn

2. Gutachter: Prof. M. Wolf

Angefertigt im Fritz-Haber-Institut der Max Planck Gesellschaft, Berlin

Ad Elvira
ed al divenuto Pietro

Contents

1	Introduction	3
1.1	Crystals, surfaces and interfaces	3
2	Experimental techniques for surface physics	9
2.1	Photoemission spectroscopy	9
2.1.1	Angle resolved spectroscopy	12
2.1.2	Core level spectroscopy	13
2.2	LEED and STM	15
2.3	Ultra high vacuum	17
3	SiC(0001) cleaved surface reconstructions	19
3.1	Semiconductor surfaces	19
3.2	Semiconductor surface reconstructions	22
3.2.1	The IV group elements and the IV-IV compound semi- conductors	24
3.2.2	6H-SiC(0001) polar surface	26
3.3	Experimental set up	29
3.4	6H-SiC(0001)(2×1): experimental results	29
3.4.1	LEED	29
3.4.2	Core level spectroscopy	31
3.4.3	Discussion	35
3.5	Conclusions	37
4	Thin Manganese films on Si(111)	39
4.1	Transition metal silicides	39
4.2	Experimental set up	42
4.3	Experimental results	43
4.3.1	Morphology	44

4.3.2 Spectroscopy	49
4.4 Conclusions	57
5 Al-Mg alloy thin films on Si(111)	59
5.1 Simple metals and binary alloys	61
5.1.1 Binary alloys	62
5.2 Photoemission and QWS	66
5.3 Experimental setup	68
5.4 Experimental results: ARUPS	70
5.5 Collective excitations in simple metals and alloys	79
5.5.1 Experimental results: CIS spectroscopy	85
5.6 Conclusions	91