



Universiteit  
Leiden  
The Netherlands

## **Knocking on surfaces : interactions of hyperthermal particles with metal surfaces**

Ueta, H.

### **Citation**

Ueta, H. (2010, November 16). *Knocking on surfaces : interactions of hyperthermal particles with metal surfaces*. Retrieved from <https://hdl.handle.net/1887/16153>

Version: Corrected Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/16153>

**Note:** To cite this publication please use the final published version (if applicable).

# **Knocking on Surfaces**

**interactions of hyperthermal particles with metal surfaces**

PROEFSCHRIFT

ter verkrijging van  
de graad van Doctor aan de Universiteit Leiden,  
op gezag van Rector Magnificus prof. mr. P. F. van der Heijden,  
volgens besluit van het College voor Promoties  
te verdedigen op dinsdag 16 november 2010  
klokke 15:00 uur

door

Hirokazu Ueta

geboren te Ibaraki, Japan in 1980

## Promotiecommissie

Promotor: prof. dr. A. W. Kleyn

Co-promotor: dr. M. A. Gleeson

Overige leden: prof. dr. J. Brouwer  
prof. dr. B. E. Nieuwenhuys  
dr. L. B. F. Juurlink  
prof. dr. F. Bijkerk  
dr. P. A. Zeijlmans van Emmichoven



This work is part of the research programme of the Stichting voor Fundamenteel Onderzoek der Materie (FOM) and is supported financially by the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO). It is supported by the European Communities under the contract of Association between EURATOM and FOM and carried out within the framework of the European Fusion Programme.

Cover: the photos were taken at De Hoge Veluwe National Park.

ISBN: 978-90-8559-097-2

# Contents

1. Introduction.....	1
1.1 General introduction .....	1
1.2 Experimental setup.....	6
1.3 This thesis .....	9
1.4 Significance.....	10
Bibliography .....	11
2. Scattering of Hyperthermal Argon Atoms from Clean and D-covered Ru(0001) Surfaces.....	15
2.1 Introduction.....	16
2.2 Experimental .....	17
2.3 Results.....	18
2.3.1 Angularly resolved intensity distributions .....	18
2.3.2 Angularly resolved energy distributions .....	20
2.3.3 Comparison with results from Ag(111) .....	22
2.3.4 Two-component TOF distributions.....	24
2.4 Discussion .....	26
2.4.1 Ar scattering from Ru(0001): Angular distributions .....	26
2.4.2 Ar scattering from Ru(0001): Energy distributions .....	29
2.5 Conclusions.....	32
Bibliography .....	32
3. The Interaction of Hyperthermal Argon Atoms with CO-covered Ru(0001): Scattering and Collision-Induced Desorption.....	37
3.1 Introduction.....	38
3.2 Experimental .....	39
3.3 Results and Discussion .....	40
3.3.1 Collision induced desorption of CO by Ar .....	40
3.3.2 Ar scattering from CO-covered surface .....	45
3.4 Conclusions.....	51
Bibliography .....	51
4. CO Blocking of D <sub>2</sub> Dissociative Adsorption on Ru(0001).....	55
4.1 Introduction.....	56
4.2 Experimental .....	57
4.3 Results.....	58
4.4 Discussion .....	60
4.5 Conclusions.....	66
Bibliography .....	67

5. Scattering of Hyperthermal Nitrogen Atoms from the Ag(111) Surface .....	71
5.1 Introduction.....	72
5.2 Experimental.....	73
5.3 Results and Discussion .....	75
5.4 Conclusions.....	83
Bibliography .....	84
6. The Interaction of Hyperthermal Nitrogen with N-covered Ag(111).....	87
6.1 Introduction.....	88
6.2 Experimental.....	89
6.3 Results.....	90
6.3.1 N scattering .....	90
6.3.2 N <sub>2</sub> scattering.....	92
6.4 Discussion .....	94
6.4.1 N scattering .....	94
6.4.2 N <sub>2</sub> scattering.....	96
6.5 Conclusions.....	101
Bibliography .....	101
Summary .....	105
Samenvatting.....	107
要旨.....	109
List of publications .....	113
Curriculum vitae .....	115
Acknowledgements.....	117