



Luca Vattuone

Associate professor

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Education and training

1994

Ph. D. in Physics

Dynamics of the interaction O₂/Ag(110) sticking coefficient and dissociation
Università di Genova - Genova - IT

1990

Master in Physics

Design and construction of a third generation High Resolution Electron
Energy Loss Spectrometer - 110/110 cum laude
Università di Genova - Genova - IT

Academic experience

2012 - ONGOING

Associate Professor

Università di Genova - Genova - IT
Coordinator for the Material Science Degrees (present)

1999 - 2012

University Researcher (Staff)

Università di Genova - Genova - IT

1999

Physicist

Istituto Idrografico della Marina - Genova - IT

1996 - 1999

Post-dpc

INFM - Genova - IT

1996

Post-doc

Università di Genova - Genova - IT

1995

Post-doctoral Research Associate

University of Cambridge - Cambridge - GB

Language skills

English

Independent

Teaching activity

AA 2012-2013

- Fisica Generale I modulo 72361 (Corso di Laurea Triennale in IngegneriaElettrica & Corso di Laurea Triennale in Ingegneria Chimica)
- Microscopic and Spectroscopic Characterization of Materials 65292 (Corso di Laurea Magistrale in Scienza e Ingegneria dei Materiali – MasterSerpChem co-docenza con prof.ssa Paola Riani e prof.ssa Donata Mazzone)
- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di LaureaTriennale in Scienza dei Materiali, co-docente dr. Emiilio Bellingeri)

AA 2013-2014

- Fisica Generale I modulo 72361 (Corso di Laurea Triennale in IngegneriaElettrica & Corso di Laurea Triennale in Ingegneria Chimica)
- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di LaureaTriennale in Scienza dei Materiali, co-docente dr. Emiilio Bellingeri)AA 2014-2015:

- Fisica Generale I modulo 80530 (Corso di Laurea Triennale in IngegneriaBiomedica)
- Microscopic and Spectroscopic Characterization of Materials 65292 (Corsi di Laurea Magistrale in Scienza e Ingegneria dei Materiali – MasterSerpChem, co-docenza con prof.ssa Paola Riani e prof.ssa Donata Mazzone)
- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di LaureaTriennale in Scienza dei Materiali, co-docente dr. Emiilio Bellingeri)AA 2015-2016

:-Fisica Generale I modulo 80530 (Corso di Laurea Triennale in IngegneriaBiomedica)

- Microscopic and Spectroscopic Characterization of Materials 65292 (Corsi di Laurea Magistrale in Scienza e Ingegneria dei Materiali – MasterSerpChem, co-docenza con prof.ssa Paola Riani e prof.ssa Donata Mazzone)-
- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di LaureaTriennale in Scienza dei Materiali, co-docente dr. Emiilio Bellingeri)AA 2016-2017

:-Fisica Generale I modulo 80530 (Corso di Laurea Triennale in IngegneriaBiomedica)-Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di LaureaTriennale in Scienza dei Materiali, co-docente dr. Emiilio Bellingeri)

-Laboratorio 1 (B) 66571 (Corso di Laurea Triennale in Fisica, co-decente diprof.Francesco Buatier e prof. Sandro Squarcia)AA 2017-2018:

- Fisica Generale I modulo 80530 (Corso di Laurea Triennale in IngegneriaBiomedica)
- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di LaureaTriennale in Scienza dei Materiali, co-docente dr. Emiilio Bellingeri)
- Laboratorio 1 (B) 66571 (Corso di Laurea Triennale in Fisica, co-decente

di Luca Vattuone curriculum vitae pagina 3 prof. Francesco Buatier e prof. Sandro Squarcia)

A 2018-2019:

- Fisica Generale I modulo 80530 (Corso di Laurea Triennale in Ingegneria Biomedica)

- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di Laurea Triennale in Scienza dei Materiali)

A 2019-2029:

- Fisica Generale I modulo 80530 (Corso di Laurea Triennale in Ingegneria Biomedica)

- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di Laurea Triennale in Scienza dei Materiali)

A 2020-2021:

- Fisica Generale I modulo 80530 (Corso di Laurea Triennale in Ingegneria Biomedica)

- Fisica dei Materiali con Laboratorio II modulo 72246 (Corso di Laurea Triennale in Scienza dei Materiali)

Postgraduate research and teaching activity

Supervision of PhD students, residents and post-doctoral fellows

Tutor of the PhD thesis of: Marco Smerieri, Andrea Gerbi, Giovanni Carraro and Giulio Paolini.

PhD committees membership

2013-2019: Member of the PhD Board for Physics

Postgraduate (PhD) teaching activity

Teacher of Surface Science for the Ph. D. School in Science and Technology of Chemistry and Materials (3 cfu) Università di Genova in 2010, 2014, 2016, 2018, 2020.

Research interests

UPDATED PUBLICATION LIST AT: <http://orcid.org/0000-0003-3718-6470>

My research activity focused mainly on the following topics:

- Experimental study of gas-surface interaction by means of High resolution energy loss electron spectroscopy (HREELS),
Supersonic Molecular beams, Micro-Calorimetry on single crystals;
- Electronic surface accesses (HREELS);
- Self-assembling of amino acids on surfaces (HREELS, XPS and STM)
- Growth and characterization of ultrathin oxide and graphene films (HREELS, XPS and STM)
- Montecarlo simulations of adsorption on surfaces.

The adsorption of molecules on surfaces and the chemical reactions they

have place at the solid gas-surface interface are at the base of the understanding of the heterogeneous catalysis processes and have therefore great interest both fundamental and applicative. Reactivity is determined from the dependence of the probability of capture on translational energy and internal of the incident molecules, on the state of the surface (temperature, presence of sub-coordinated sites, presence of other adsorbed species), on the adsorption energy, on the chemical form and from the site occupied by the adsorbed species.

In the first phase of my activity I measured the capture coefficient of different simple molecules such as (O₂, C₂H₄) on monocrystalline surfaces as a function of the translational energy of the incident molecules and of the angle of

incidence showing the role of surface corrugation in the process of chemisorption (PRL 1994, 63 cits, JCP 1994, 120 cits) and energy rotational in physisorption (PRL 1999, 42 cits).

During my post-doc in Cambridge I measured by single crystal microcalorimeter the energy of adsorption of different molecules such as CO, NO, O₂, C₂H₄ C₂H₂ on (100) surfaces of transition metals (Ni, Pd and Pt) highlighting in particular the role of lateral interactions between adsorbates and their influence in determining whether molecular or dissociative chemisorption occurs (JCP 1997, 313 cit; JCP 1996, 111 cit.). To do this, I also used Montecarlo simulations.

Back in Italy, I dealt with the chemical reactivity of sites under coordinated by highlighting their role on vicinal surfaces of Ag and Cu (PRL 2001, 50 cits; PRL 2003, 47 cits; JACS 2008, 31 cits; Surf. Sci. Rep. 2008, 101 cits).

The use of vibrational spectroscopy (HREELS) has allowed, between the other, to discriminate between molecular and dissociative absorption and to determine the adsorption site. These activities have been the subject of 4 invited conference reports including ECOSS 25.

Using speed selection and alignment technique collisional that takes place during the supersonic expansion of a supersonic beam,

I produced rotational aligned beams of O₂ and C₂H₄ and C₃H₆ and I studied the influence of the rotational state on the probability of capture (Angew Chem 2004) and reaction (Angew Chem. 2006) as well as on the occupied final site (Angew Chem. 2009). These studies have been the subject of 4 invited reports including ERPS 2007 and MOLEC 2010, as well as the subject of a

Elettra Highlight and an interview of the journal 'Le Scienze'.

My activity then turned to the experimental study of excitations collective electronic devices participating in the discovery of the acoustic plasmon on Be (0001) (Nature 2007, 162 cits) and to the measure its dispersion curve on Cu (111), Au (111) and Au (788) (PRL 2013, PRL 2014). The results were presented in 5 invited reports including ECOSS 29.

I then dealt with the growth of two-dimensional films of both amino acids

and of Mg oxide (PRL 2013), highlighting in particular the role played by entropy in determining the final morphology of the system (invited talk, 248th ACS meeting).

Lately I have been interested in the experimental study of graphene chemistry showing both the role of the substrate and the effect of the presence of vacancies and doping atoms.

Grants

2019 - ONGOING

MONolithic STRain Engineering platform for TWO-Dimensional materials (MONSTRE 2D)

MIUR - IT

Participant

Principal Investigator: Prof. Alessandro Tredicucci (University of Pisa)

Head of Genoa unit: L. Vattuone

The emergence of two-dimensional (2D) layered materials such as graphene provides unique opportunities for the investigation of strain engineering and nanoscale deformation control. 2D materials typically have a remarkable mechanical strength and can be significantly elongated while remaining in the elastic regime, offering unmatched freedom in the implementation of non-trivial strain profiles. Most importantly, strain and deformation engineering are predicted to lead to a variety of fascinating phenomena including band gap modulation, the emergence of large-gap pseudo Landau levels in the absence of external magnetic fields, as well as the selective increase of chemical reactivity to specific molecules.

All these effects have just started to be explored and the goal of the project is to develop the scientific knowledge and technological platform necessary to theoretically design and experimentally implement tuneable strain profiles and nanometric corrugations in a robust monolithic device. We aim at demonstrating the potential of our approach in two application directions: novel Landau-level based optoelectronic components, operating without magnetic field, and electro-mechanically controlled systems for the molecular adsorption and desorption of relevant chemical species.

2017 - 2019

Multifunctional ultrathin Fe(x)O(y) Fe(x)S(y) and Fe(x)N(y) films with unique electronic catalytic and magnetic properties.

Foundation for Polish Science European Union - PL - PL

Participant

2010 - 2012

Drogenazione di CO₂ su Ni(110) e su clusters di Ni supportati su MgO(100)

MIUR - IT

Participant

2002 - 2004

Adsorbimento di molecole allineate su superfici. INFM-PURS 1VA-2002

INFM - IT

Principal investigator

2002 - 2004

Adsorbimento di aminoacidi su superfici di Ag(110).

British Council CRUI - IT

Principal investigator

Editorial activity

Activity as referee;

L.V. has reviewed papers for the following journals: Nature Photonics; Nature Communications; Angewandte Chemie International Edition, Physical Review Letters; Journal of Physical Chemistry Letters; Journal of Physical Chemistry C; Physical Review B: PCCP; Surface Science; Applied Surface Science.

Activity as Guest Editor:

Guest Editor (with G. Benedek) of: IOP PUBLISHING JOURNAL OF PHYSICS: CONDENSED MATTER. Phys.: Condens. Matter 20 (2008) 220301 (2pp) doi:10.1088/0953-8984/20/22/220301

Guest Editor (with R. Ferrando) of: Topical issue on "Advances in Surface Science" Eur. Phys. J. B 75, 1 (2010) DOI: 10.1140/epjb/e2010-00131-5A

Activity as Editor:

Editor with M. Rocca and Talat Rahman of: 'Springer Handbook in Surface Science' (2020)

Membership of Editorial Boards:

from 01-01-2011 to 01-06-2014: ISRN Physical Chemistry (ISSN: 2090-7761 (Online) doi:10.5402/PHYSICHEM)

<http://www.isrn.com/journals/physchem/> Papers included in the following database: Chemical Abstracts, Directory of Open Access Journals (DOAJ), EBSCO Discovery Service, EBSCOhost Connection, Google Scholar, J-Gate Portal 2)

from 01-06-2014 to termination: International Scholarly Research Notices: Member Editorial Board for: Physical

Chemistry (<https://www.hindawi.com/journals/isrn/editors/physical.chemistry/>) 3)

from 14-03-2016: Member of the Editorial Board of: The Open Access Journal of Science and Technology (Physical Chemistry

section) <http://www.agialpress.com/journals/oajost/editorialboard/4>)

Member of the Editorial Board of 4 Open, <https://www.4open-sciences.org/>

2020- ongoing: Member of the Editorial Board of *Coatings*

<https://www.mdpi.com/journal/coatings/editors>

Assignments abroad

Post-doctoral Research Associate at:

Department of Chemistry University of Cambridge (UK).

Group leader: prof. D.A. King, FRS

Funding: Fondazione Angelo della Riccia.

dal 01-01-1995 al 01-12-1995