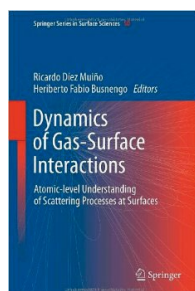


RECENSIONI



RICARDO DÍEZ MUIÑO, HERIBERTO FABIO BUSNENGO (EDITORS)

DYNAMICS OF GAS-SURFACE INTERACTIONS
ATOMIC-LEVEL UNDERSTANDING OF SCATTERING PROCESSES AT SURFACES

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It is a privilege to review a book which has the same title of a book that Ugo Valbusa and I edited in 1981 (also by Springer) collecting the lectures held at Ettore Majorana Center in Erice. The new book, beautifully organized and edited by Ricardo Díez Muiño and Heriberto Fabio Busnengo has however an important sub-title: *atomic-level understanding of scattering processes at surfaces*, something which was at its infancy in 1981. It is interesting and refreshing to weigh the huge progress in the field made since that time. The key argument to advertise surface science was that surfaces, besides hosting in two dimensions all what occurs beneath in three dimensions, also join different physical systems and, metaphorically, different disciplines.

The editors start their Preface quoting William Blake's *The Marriage of Heaven and Hell*. Whether the solid is the hell and the gas is the heaven or viceversa it is a matter of taste and experience, but for sure surface physics encompasses both features in terms of complexity and excitement. As noted by the editors, the first revolution (since 1981, the year of STM invention by Heini Rohrer and Gerd Binnig) was the possibility of growing surfaces of high perfection with an atomic-scale control of surface features, and to make a wide spectrum of nanotechnologies viable, where surfaces and interfaces play a dominant role.

The second revolution was on the quantum computational side. The reduction of system size to the nanoscale on one side, and the

parallel increase in computer power so as to enable quantum simulations on the same scale, have closed a gap which looked like science fiction thirty years ago, and permits today to replace expensive experiments with reliable molecular dynamics simulations. Consequently the field of gas-surface interaction is exploded: despite the sub-title specification the authors warn the reader that the more than respectable 428 pages of the volume for 16 review articles can only cover a selected part of the vast knowledge accumulated in the field. The deposition and the structural and chemical characterization of physi- and chemisorption processes and phases by means of molecular beams, the surface reactions, the role of non-adiabatic processes and the related vibrational spectroscopy are the major subjects of the book.

The reader can find articles on the molecular beam techniques and the study of surfaces ordered phases with molecular beam diffraction; on the potential energy surfaces for elementary gas-surface processes as obtained from analytical and numerical analysis; the interaction of molecular hydrogen with conducting surfaces, including graphene and silicon surfaces; the role of lattice vibrations and the theory and simulation of non-adiabatic effects; the surface reaction dynamics of methane on metal surfaces; the scattering of hyperthermal nitrogen and the adsorption dynamics of molecular oxygen on transition metals. The authors themselves have

contributed two important chapters. One by Heriberto Busnengo and his group on the dynamics of molecular hydrogen interacting substitutional bimetallic surface alloys. No need to explain the importance of these studies for the development of novel catalysts and several other nanotech applications. The other chapter, by Maite Alducin, Ricardo Díez Muiño and Iñaki Juaristi, concerns the energy dissipation channels in reactive and non-reactive scattering at surfaces. The authors approach the challenging problem of calculating the energy transfer in gas-metal surface interaction to both vibrational and electronic degrees of freedom, by combining the generalized Langevin oscillator model for phonon excitations and the local density friction approximations for electronic excitations. Altogether the volume collects the work carried out by many among the best groups and authors in the field, including the excellent contributions from the editors' home-institutions, the CONICET-UNR at Rosario, Argentina and, last but not least, the Centro de Física de Materiales of CSIC, and the Donostia International Physics Center (DIPC) of the Basque Country University at San Sebastian. This important book is a must for all surface science laboratories.

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