

BOOK REVIEW

Atomic and Ionic Impact Phenomena on Metal Surfaces. By MANFRED KAMINSKY. Academic Press, New York; Springer-Verlag, Berlin, Heidelberg, 1965. v + 402 pp. \$14.50.

The collision of neutral or charged particles with surfaces is an essential step in many physical and chemical processes. Its study has been an important tool in understanding surfaces. The development and routine use of ultra-high-vacuum techniques in the past fifteen years has stimulated the experimental study of many areas of surface science but only a few books have yet tried to summarize recent work which has been done under well-defined conditions. This book presents in considerable detail experimental work on the interaction of charged and neutral gaseous particles of different energies with metal surfaces. Its treatment of theoretical approaches to the problems is much less complete. The list of references is extensive. The book will be most useful to the specialist working in the general field of collisional processes. For someone not working directly in this area, it is too detailed to provide an elementary introduction to the problems of collisions at surfaces.

The opening sections discuss the structure of surfaces and the nature of surface heterogeneities, the nature of binding forces of molecules and atoms at surfaces, methods for producing clean surfaces and the energetics of surface reactions. The emphasis is on the inherent structural heterogeneities of metal surfaces. It provides a useful summary of the detailed picture of surface processes that has developed from experimental techniques such as field-emission and field-ion microscopy, work function measurements, and flash filament measurements. These sections stand largely by themselves. Although such chemical information is essential for detailed understanding of surface collisions, it is utilized to a surprisingly

small extent in the discussions of collision processes which follow.

The bulk of the book is concerned with collisions of particles with surfaces. Topics covered include thermal accommodation coefficients, the emission of positive and negative ions at surfaces, sputtering of metal surfaces, ion scattering from metal surfaces, neutralization and de-excitation of ions and metastable species, and the kinetic emission of electrons by bombardment of surfaces with particles. An impression from this part of the work is of a wealth of experimental detail, often conflicting, and a paucity of theoretical understanding. The proliferation of experimental investigations in the past fifteen years has not been accompanied by a parallel development of theoretical concepts. The presentation of topics reflects the experimental nature of the subject. In the first half of the book, each chapter is preceded by a brief theoretical section which introduces and provides a framework for the experimental methods and results. Theory is not presented in detail but the experimental quantities are defined and the reasons for investigating them are given. In several chapters in the last half of the book, experimental methods and results are presented before theoretical models and understanding of the subject are discussed. As a consequence these sections are harder to follow; details obscure the broader perspective of collisional processes at surfaces. The printing of the book is good. However, there are many minor typographical errors and the system for numbering of sections, equations, and figures detracts from the clarity of the general organization.

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