Chemistry and physics of solid surfaces

N.S. Maslova

Usp. Fiz. Nauk **161**, 188–189 (April 1991)

Chemistry and Physics of Solid Surfaces VIII, **R. Vanselow and R. Howe (eds.)**, Springer-Verlag, Berlin, Heidelberg, 1990, p. 464 (Springer Series in Surface Sciences, Vol. 22).

This book contains the manuscripts of review lectures, delivered at the Ninth International Summer Institute In Surface Science (ISISS-1989), held in August 1989 at the University of Wisconsin, Milwaukee. The contents of the book can be provisionally divided into two parts. The first part is devoted to problems of surface reactivity, heterogeneous catalysis, and investigation of mechanisms of activation, chemisorption and desorption of molecules on surfaces (reviews by Ertl, Ceyer, White *et al.*). The second part contains descriptions of today's methods for studying surfaces, such as low-energy electron diffraction (LEED) and low-energy positron diffraction (LEPD), scanning electron microscopy with a study of polarization, scanning electron microscopy, scanning tunneling microscopy, and spectroscopy (STM) and (STS), atomic force microscopy (AFM) (reviews by Canter, Unguris, Bauer, Tersov, Avouris, Colton and others).

The relationship between heterogeneous catalysis problems and studies of the reactivity of different atoms and molecules on surfaces is discussed in the reviews by Ertl and Ceyer. The review by White and the review by Madey, which is closely related to it, are devoted to photochemistry, a study of activation and desorption mechanisms, especially the problem of breaking molecular bonds during electron transitions and in interactions with photons.

Most of the metal catalysts being used today are small metal particles. Sachtler in his review deals with the question of the preparation of samples containing small metal clusters and studies of their reactivity.

Among the numerous methods being used today to study solid surfaces we can isolate those that are expanding the fastest: scanning tunneling microscopy and spectroscopy and atomic force microscopy. The STM and STS methods, based on the quantum tunneling effect between the probe tip and the specimen, make it possible to examine with atomic resolution the topography and electron structure of a surface. However, the interpretation of the experimental data obtained by means of the scanning tunnel microscope is not a simple problem. Tersov's review contains a theoretical analysis of the interpretation STM images. The author points out the significant differences between the images of metal surfaces and of semiconductors. The review by Avouris is devoted to using STM and STS for investigating the reactivity of individual surface atoms. On the basis of his work investigating the reaction of NH_3 with the reconstructed $Si(111) - 7\times7$ surface the author concludes that the reactivity of different surface atoms depends on their electron structure, more precisely, on the presence of localized dangling bonds on the surface.

Problems in studying the surface of insulators and intermolecular interaction forces by means of AFM are discussed in the review by Cohen.

As a whole, the book is of interest for a wide circle of readers involved in studying the surface of solids. It provides an accessible description of the problems existing in this field and it also contains the results of recent investigations.

Translated by Eugene R. Heath