SURFACE PHYSICS

There is a growing interest in fundamental studies of surfaces, stimulated in part by the advent of new experimental techniques capable of characterizing the surface of a microscopic level, and in part by the relevance of research on surfaces to some very practical problems facing our technological society. These problems are found in areas such as heterogeneous catalysis, corrosion, embrittlement, photocells and many solid-state electronic devices. A good example is methanation, in which methane is produced via the reaction of H_2 and CO with a metal catalyst. Although this simple reaction is of great practical importance, the mechanism underlying it is not known, and the reasons for nickel's outstanding specificity to methane are not understood.

An important topic in fundamental surface research, which is relevant to the practical problems mentioned above, is the nature of the bond between an adsorbate and a surface. This area encompasses not only static adsorption but the dynamics of adsorption including the kinetics, reaction paths and intermediate species. The five articles included in this special issue are primarily concerned with simple static adsorption, with the aim of illustrating the state of the art experimentally and theoretically. They provide, we believe, a useful fundamental perspective on the progress being made in studies of adsorption (primarily strong adsorption, chemisorption) to produce a relatively simple microscopic model with predictive powers.

The first piece, "Theory of the electronic structure" by J. Robert Schrieffer and Paul Soven, is an introduction to the theoretical models used to understand surface phenomena. The second article, "The geometry of surface layers" by Peder J. Estrup, reports on the efforts to obtain a picture of the geometrical arrangement of atoms in the surface layers. The remaining three pieces ("Photoelectron spectroscopy" by Dean E. Eastman and Marshall I. Nathan, "Inner-shell spectroscopy" by Robert L. Park, and "Vacuum-tunneling spectroscopy" by E. Ward Plummer, John W. Gadzuk and David R. Penn) each discuss the experience with an important spectroscopic technique and the kinds of information about surfaces that can be obtained with the technique.