Dielectric Behavior of Physically Adsorbed Gases. By ROBERT L. MCINTOSH. Marcel Dekker, Inc., New York, 1966. xii + 160 pp. Price $9.75.

This is a relatively short monograph dealing with the dielectric properties of adsorbed gases, written by one of the leading exponents of the technique. No mention is made of the audience for which the book is intended, but it would seem intended either for graduate students or for people actively engaged in research in the field of solid–gas interactions. For example, no historical review of the development of the subject is given.

The field covered in this book does not seem to have become a very popular one. Part of the reason for this may be the rather difficult experimental technique involved, but in addition, the theoretical interpretation of the data poses even more formidable problems. For example, in spectroscopic fields such as the visible, UV, infrared, and nuclear magnetic resonance, the spectral data obtained with adsorbed species can be readily interpreted with reference to the spectral characteristics of the pure adsorbent in its various phases (gas, liquid, and solids), and adsorbents can be chosen whose spectrum does not overlap that of the solid. No such simplicity exists in the measurement of dielectric constant.

Initially, measurements have to be made of the cell containing the evacuated adsorbent. Then, after adding known amounts of the adsorbate, the electrical properties are remeasured. The only simple interpretation of such data is to assume that the electrical properties of the adsorbent are not changed by the adsorbed material. This assumption of the solid being inert is used in many thermodynamic treatments of physical adsorption at the solid–gas interface and, in general, is not rigorously true. This has been shown by many techniques, but in the present context is well illustrated by the first reference cited in Chapter 1. It was found, in the adsorption of ethyl chloride onto porous glass, that the total capacity of glass plus adsorbate was less than that of the glass alone. Under such conditions, the inert adsorbent theory is obviously inapplicable, as pointed out by the author.

This particular difficulty of dielectric measurement is not discussed in any detail in this monograph, but several other problems of the method are discussed at length. For example, the experimental techniques are difficult because the amount of adsorbed gas is necessarily small compared to that of the adsorbent, even for high surface area solids. An even more difficult problem is that of the theoretical treatment of the data. The calculation of the polarization of the adsorbate is considered in detail in Chapter 2. The author concludes that "It cannot be claimed that a satisfactory solution of the primary difficulty has been achieved; in the following section an attempt is made to clarify the assumptions underlying each of the various procedures and to compare the treatments." This aim is, I think, well achieved, and a balanced account is given of the difficulties of interpretation of these measurements. The rest of the book consists of a detailed chapter on experimental methods and on results with porous adsorbents. The final chapters deal with data on polymers, cellulose, and so on, and finally with nonporous solids.

The treatment of the book is selective rather than comprehensive, as stated by the author in the Preface. His aim is stated to be "To deal with those systems which have been most thoroughly investigated and which offer the best opportunity of allowing a quantitative interpretation of the experimental data." It would seem that he has achieved this aim, and this is a very useful monograph which will be needed by all workers in this field. Nevertheless, in this reviewer's opinion it would have been helpful to the reader trying to get a general picture of the field to have had a comprehensive list of references of all work done on this topic as an appendix. I am sure that the author must have this information at hand, and it would seem that its inclusion would improve the book.

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