

quently avoided at the outset in order to bring out the physical differences between limiting cases. Thus, the separate treatment of double injection into insulators and semiconductors is very welcome. Attention is also paid to the role of contacts and current-flow geometry. The experimental data in the field are well covered, and the breakdown into different materials is very welcome. Of particular interest in connection with double-injection phenomena is the frequent occurrence of current-controlled negative resistance characteristics. The authors give the theory of such a mechanism, brought about by the combination of double-injection and trapping effects, but they also give examples of other mechanisms that can produce a negative resistance. A mild criticism of this part of the book is that rather brief attention is paid to the question of current filament formation, which, according to some authors, always sets in when such a negative resistance device is switched from its high voltage threshold to its low voltage state.

As a reviewer who is not a specialist in the field but has some familiarity with the subject I found the book very instructive and useful, and can highly recommend it to a broad audience of semiconductor scientists.

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Chemical Analysis

Topics in Organic Mass Spectrometry. A. L. BURLINGAME, Ed. Wiley-Interscience, New York, 1970. xii, 472 pp., illus. \$22.50. *Advances in Analytical Chemistry and Instrumentation*, vol. 8.

The goal of the editor of this volume is to assess current areas of active research in mass spectrometry, a task that is exceedingly difficult because of the rapid progress that is being made in this field. The latest reference I found in this book was 1968, and one chapter's most recent reference was 1965. Thus, I feel that the editor has not achieved his goal. The time lag is very apparent in the chapter on combined gas-liquid chromatography and mass spectrometry, where the authors claim that in the time-of-flight mass spectrometer differential pumping between the ion source and the drift tube

is not possible and that there are no data available regarding the performance of gas chromatographs coupled to quadrupole mass spectrometers.

On the positive side, the editor has assembled an impressive array of authorities on various aspects of mass spectrometry, and the book achieves a good balance between the principles and the applications of mass spectrometry.

The first chapter is an excellent discussion of the various methods of ionization employed in the study of organic materials. The authors (Becky and Comes) have presented a readable account of the strong and weak points of the various approaches to ionization, particularly field ionization. I had hoped that this chapter would devote more discussion to comparison of field and chemical ionization than to comparison of field and electron-impact ionization. The former pair is employed by many more organic chemists to obtain the same type of information (identity of the molecular-weight or quasi-molecular-weight ion) than the latter pair.

The second chapter, by la Lau, provides an excellent discussion of some factors of which many organic chemists using mass spectrometers are unaware, namely, discrimination at the electron multiplier. On page 109 la Lau appears to have mixed his usage of the symbols γ_r and γ_{r1} . The chapter by Harrison presents an interesting approach to fragment ion structures—the use of ion energetics. I take issue with Harrison on several points, however. First, the statement on page 125 that appearance potentials are identified with enthalpy changes (ΔH) does not make clear to a novice the assumptions employed when appearance potentials are used as heats of reaction. The appearance potential is defined as ΔE , and since $\Delta(PV)$ can be assumed negligible for these gas phase reactions, appearance potentials may be assumed equal to heats of reaction. Also, it is assumed in the use of the tabulated standard heats that ΔH is essentially temperature-independent. Many ion sources are operated at elevated temperatures (250°C), but the tabulated ΔH values are given for 25°C. Second, Harrison discusses, on page 139, the need to know the path of the ionic reaction for the determination of the ionic heat of formation. When one is using appearance potentials as heats of reaction, only the identity of the original compound and products, both

ionic and neutral, and their heats of formation are required to determine the heat of formation of an ion. The chapters by Bieman, McLafferty, MacFadden and Buttery, and Schnoes and Burlingame give excellent accounts of research in the various areas of organic mass spectrometry and are to be recommended.

This volume is readable, although not too current, and would be of use to a chemist not engaged in mass spectrometry research.

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