Thermochimica Acta, 48 (1981) 251—252
Elsevier Scientific Publishing Company, Amsterdam — Printed in Belgium

Book Review

Porous Silica, K.K. Unger, Elsevier Scientific Publishing Company, Amsterdam, 1979, 336 pp., $58.00.

The present reviewer draws the attention of thermal analysts to the material as well as the topic of the book. The author of the book reviews the properties of the material with an emphasis on its use as a column support in liquid chromatography. This is only proper as the book, in fact, forms Volume 16 in the series *Journal of Chromatography Library*. The reviewer would, however, recommend the material set out in this book, especially the first four chapters, as providing a basic knowledge which could serve as a basis for a wide-ranging set of investigations in the field of thermal analysis. Foremost among these topics is the investigation of the manner in which water is held on or in a porous silica. The subject eventually involves making a distinction between chemisorbed and physisorbed water. An investigation of this kind deals with surface texture studies, infrared spectroscopic data, and details of the manner in which water is lost on heating silica to various temperature regimes. The result of present work is confusing as some authors claim that the two kinds of water can be differentiated by heating to 120°C while others recommend higher temperatures. The temperature probably varies as the type of silica is varied. The range of silicas available is made apparent in this book by the strict attention to detail provided by the author.

The first chapter deals with the general chemistry of silica and provides a complete description of the surface structure of silicas with a detailed enumeration of the type of surface hydroxyl groups that may be present and which would be the basic information required in the thermal analysis problem cited above. The author points out the thermal transitions occurring in silica, and of course the β—α transitions which appear in cristobolite, tridymite and quartz serve as a valuable method of identification using thermal analysis equipment.

The thermal behaviour of a silica cannot be divorced from its pore structure and Professor Unger devotes a complete chapter to this topic, dealing especially with methods of obtaining such data from adsorption isotherms. The mercury porosimetry method is also described in some detail. The author points out that, generally, heat treatment of a porous silica up to 673—773 K does not affect its pore structure, but above this temperature sintering takes place, resulting in a gradual decrease in both the specific surface area and the specific pore volume. At temperatures higher than 1473 K, non-porous products are obtained. He goes on to explain that, in the range 473—673 K, mainly vicinal or paired hydroxyl groups condense at the surface, forming strained siloxane bonds. Above 873 K, there occurs an intraparticulate condensation of free hydroxyl groups together with a rearrangement of silica globules to produce a more stable configura-

tion. The crystallization rate is significant above 1073 K, leading to a further stabilization of the siloxene network. The sintering characteristics and the pore network are greatly influenced by the conditions of formation and this should always be noted when embarking on any thermal analysis investigation of a porous silica.

The third chapter deals with the surface chemistry of porous silica, especially its ability to undergo modification by surface reaction and ion exchange. The scope for thermal analysis studies in this field is really enormous and has, of course, been realised by some investigators.

The remaining chapters of the book deal with particle characteristics, silica columns in chromatography, silica and its chemically bonded derivatives as adsorbents in liquid–solid chromatography, chemically modified silica as a packing in ion exchange chromatography, and silica as a packing in size exclusion chromatography. The author is to be congratulated in producing a book of such meticulous merit and in providing the thermal analyst with a broad field of investigative possibilities.

D. DOLLIMORE
(Salford, Gt. Britain)