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G. Horányi (ed): Radiotracer studies of interfaces, vol 3. (The Interface Science and Technology Series)

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This book consists of ten chapters covering a wide variety of applications of the radiotracer technique to studies of interfacial phenomena. The book demonstrates that this technique is a very powerful and versatile way to investigate a variety of phenomena, such as adsorption or electrosorption at solid/gas, solid/liquid and liquid/fluid interfaces, colloidal systems, and transport phenomena in solids as well as in membranes, including biomembranes. It is a very good and up-to-date book with references to primary literature published as recently as 2004. All of the authors are Hungarian—just like G. Hevesy, who received the Nobel Prize in Chemistry in 1943 for his pioneering work in the use of isotope tracers to study chemical processes. One can read a short biography of Hevesy in the Preface of this book, and Chapter 1 gives a vivid historical survey, citing the most competent person of the field, G. Hevesy himself.

Like the previous sections, Chapter 2 is also written by G. Horányi and it gives a concise but excellent summary of the advantages of radiotracer techniques. Chapter 3, written by Z. Schay, is devoted to adsorption and catalytic reactions at solid/gas interfaces, and it presents abundant examples related to the characterization of heterogeneous catalysts as well as to studies of catalytic reaction mechanisms. Chapter 4 will probably be the most exciting chapter to electrochemists, because it deals with electrified solid/liquid interfaces. It is an authoritative review by G. Horányi, involving all aspects of the topic. It gives information on specific methods that can be used to study different phenomena, the theoretical background for the topic, and even the most important relationships between the measured radiation

intensity and electrochemically relevant quantities (such as surface concentration). It is shown that fundamental questions about electrode processes can be answered with the help of radiotracer methods. The central issue is the dependence of ionic and molecular adsorption on the potential and the concentration; however, besides simple electrosorption, convincing examples are presented concerning co-adsorption, induced adsorption, the mobility or immobility of adsorbed species (chemisorption), and underpotential deposition. The relationship between the rates of electrode processes and coverage is also emphasized. The usefulness and capability of the radiotracer technique is also demonstrated in such areas as conducting polymers formed by electropolymerization and the characterization of ion sorption processes in these films, the deposition and dissolution (corrosion) of metals, as well as in the investigation of oxide powders. Chapter 5 by P. Joó and K. László-Nagy deals with colloidal systems where adsorption phenomena obviously play a central role. The authors show that the adsorption of different substances on colloid particles is interesting not only from a purely scientific perspective but also from a more practical viewpoint: such effects can be utilized to clean up the environment—for example to remove radioactive wastes.

Chapter 6 by G. Horányi is devoted to liquid/fluid interfaces. It is a relatively short section, although the importance of such systems, both theoretically and practically, are clearly elucidated and the unique information that can be gained from radiolabeling is well presented.

Results from studying solid/solid interfaces using radiotracer techniques are summarized by G. Erdélyi, D.L. Beke and I.A. Szabó in Chapter 7. The authors first survey diffusion and self-diffusion studies, where the radiotracer experiments have opened up new vistas, and then they focus on studies of grain boundaries, interface diffusion and segregation. Recent results on nanoscale effects are also treated.

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The classical field of isotopic indication in life sciences is represented by Chapter 8, entitled "Sorption (binding) and transport phenomena in biomembranes", by J. Kardos. This rather extensive review demonstrates the essential role of radiotracer techniques in this research. It includes the identification of receptors, determinations of the number of binding sites, and investigations into the rates of various processes, such as ion transport through cell membranes, translocation of neurotransmitters, hormones, and so on.

Chapter 9 by A. Kolics provides a useful survey of the technical background of the various electrochemical cells developed so far, nuclear instruments (detectors, multipliers, analyzers, and so on), the radionuclides used in these measurements, and the methods used to calculate the surface concentration from the radiation intensity. There is some overlap with Chapter 4 regarding the formulae, although this is hard to avoid in a multiauthor book.

Chapter 10 consists of two parts. The first one by K. Varga deals with the important problem of the contamination/decontamination of nuclear reactors. The inherent link between nuclear engineering and chemical/electrochemical processes and methods is outlined. An interesting compilation of reactors and standardized methods applied in different countries can be found in this section.

The second part of this chapter, written by Á. Veres, deals with environmental problems related to radioactive isotopes, and radioactive waste management, which is certainly of high societal concern.

A good subject index helps the reader at the end of the book.

The Editor did an outstanding job concerning the selection of the most interesting topics in this area, and invited experts to write the respective chapters. Because the chapters were written by several authors they are somewhat different in style. The terminology and figure constructions used in different areas of the book are mostly harmonized successfully; only a few figures taken from the original papers show diversity in this respect. While the quantity calculus form has been used in chapters written by G. Horányi, a rather mixed and erroneous usage can be seen in other sections. Physical quantities are mostly written correctly in italics, although Roman (upright) letters are used in some cases in the text and on many figures. While the unit "cal" may still be used in the life sciences, to give the Faraday constant in cal/volt/mol is a little bit strange. Nevertheless, these are only a few mistakes and inconsistencies, that do not detract from the overall value of this well constructed book.

This book is an excellent introduction to the field of radiotracer studies on interfacial phenomena. It reports many of the latest, state-of-the-art experimental observations which are explained in a clear and comprehensible manner. Therefore, I can warmly recommend this book, first of all to electrochemists, solid-state physicists, biologists, and nuclear engineers, but also to researchers, engineers and students in many other areas of sciences and industry.