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H. Bach, F. Baucke, D. Krause (eds): *Electrochemistry of glasses and glass melts, including glass electrodes*

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This is a remarkable book. Very largely, it is an account of a lifetime's achievement in electrochemical research carried out by Friedrich Baucke during his time at Schott Glaswerke in Mainz, Germany. The outcome provides fascinating insights into the many links existing between electrochemistry and glass science, and will surely stimulate others to venture into areas of research where important questions remain unanswered, and opportunities for technological development are even now awaiting exploitation.

The main body of the text falls conveniently into three chapters. The "overview" in Chapter 1 repays especially careful study. It brings together several topics, ranging from fundamental notions of ionic transport, to the mechanisms of glass corrosion and of the glass electrode, to practical aspects of electrochromism, which are seldom considered together either at scientific conferences or in the technical literature. Baucke's style is refreshingly open-minded. He does not shrink from expressing views on such contentious topics as the mixed-alkali effect, where he is surprised that such a large gap in understanding exists, which he says has "no parallel in other fields of glass science". His challenge to the glassy ionics community is to come up with fresh experimental information which will "lift the veil" on the secrets of the mixed-alkali effect. This challenge will certainly not go unheeded – perhaps by the time a second edition of this book is published the problem will be solved!

Chapter 2 on "electrochemistry of solid glasses" contains a wealth of information concerning these fundamental issues. It begins innocently enough with a discussion of the thermodynamics of glass electrodes, which in the literature usually means making reference to the Nicolsky equation (1937). This equation has

dominated much modern thinking about glass electrodes and has tended to stifle a more profound discussion of electrode mechanisms. Baucke speaks of a "Nicolsky hiatus", clearly drawing an analogy to the "Nernstian hiatus", which Bockris had earlier blamed for slowing down progress in electrochemistry more generally.

Baucke's own concept of the pH response of glass electrodes draws attention to the notion of the "electrified interface", and is supported by his detailed studies of ion migration in the presence and absence of electric fields. The detailed profiling of ionic concentrations within the surface layers of glass relied heavily on IB-SCA (ion bombardment for spectroscopic chemical analysis), which comprised a range of surface techniques developed jointly by Baucke and Dr. Hans Bach at Schott's laboratories in Mainz.

These experimental studies have not received, perhaps, the attention they deserve from the academic community at large. They will yield up to the careful reader an abundance of information on "guest ion"-matrix interactions and the extent to which changes in network structure either circumvent or facilitate the processes of ion transport.

Chapter 3 deals with "electrochemistry of glass forming melts". Here there will be much that is new either to scientists or to glass technologists. There is much practical information on sulfate fining (supplied by Baucke's colleague, Detlef Köpsel) and on the use of zirconia electrodes to measure oxygen activity which is directly relevant to the glass making process.

Less expected is the move away from the restrictions imposed by classical thermodynamics to discuss acid-base and redox chemistry in the context of the optical basicity concept. John Duffy (Aberdeen University) describes how redox potentials in silicate melts at elevated temperatures and in aqueous solutions at ambient temperatures can be "scaled" in terms of optical basicity values by making appropriate assumptions. This is clearly a concept worth taking further forward.

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This is a book which should be read by anyone active in glass research, especially if they want to make new connections between theory and practice. There is much to challenge the preconceptions of electrochemists, ce-

ramic engineers, chemists and physicists. This is not a "textbook" on glass. However, there is a lot of information here, and a very comprehensive bibliography for those who wish to delve further into the subject.