

PREFACE

The emerging constraints related to energy production, which are already shaking our economies, will undoubtedly increase. Our societies will not only have to produce the tens of terawatts of energy they require while resorting less and less to fossil fuels (a fact that implies that electrical energy will dominate), but will also need to find adequate ways to use and store the transient electrons thus produced. These are considerable challenges that our present world is not ready to fulfill with its current technologies. New technologies will have to be envisioned for the efficient management of the considerable fluxes required, and to this end, *Electrochemistry* seems to provide some of the most promising and versatile approaches. *Electrochemistry* will be involved in solar cells, electrolytic cells for the production of hydrogen through water electrolysis or the reductive recycling of carbon dioxide, supercapacitors and batteries for the storage of electricity produced intermittently by solar cells and windmills, as well as in the use of electrons as chemical reagents, and so on. This is a vast program that will require the dedicated and skilled competence of thousands of researchers and engineers, which is in stark contrast with the present status of electrochemistry in many industrial countries, where its main focus is the never-ending fight against corrosion or improvement lead car batteries.

There will be a requirement for much more knowledgeable and versatile electrochemists than are currently trained in our universities and engineering schools, which is tantamount to saying that our teaching of electrochemistry must evolve drastically. Indeed, even if today one can easily foresee the great challenges that electrochemists will face, nobody can know for sure which sustainable and economically viable solutions will emerge, be selected and even how they will evolve. But to occur all of this will necessarily be rooted on a deep understanding of the fundamental principles and laws of electrochemistry. Future electrochemical researchers and engineers will unquestionably adapt, but this can only happen provided that their knowledge is firmly and confidently mastered. We should recall the great Michael FARADAY's answer to the Prime Minister of his time, who asked him about the purpose of understanding electricity and electromagnetism: *Sir, I certainly don't know, but I am sure that within thirty years you will be taxing its applications.* To paraphrase him: Today we do not know how electrochemistry will solve the great challenges ahead, but we do know that nothing will be possible without a deep understanding of this science.

Within this context, it is a great pleasure to see the present increasing number of new electrochemistry textbooks, though sadly many of them continue to be written not to provide students with a deep understanding, but rather with operational conceptual recipes; this is certainly handy and useful knowledge, but it is ultimately rooted on sand. So it is my great pleasure to see that a few colleagues, the authors of this book among them, have undertaken a deeper pedagogical questioning to produce a new type of electrochemistry textbook for students in their freshman years.

This book offers new approaches to the teaching of electrochemical concepts, principles, and applications. It is based on a translation and improvement of a previous version written by the same authors for French-speaking students, so its efficiency has already been tested in excellent French universities and engineering schools. In fact, these new approaches were primarily elaborated and refined by one of the authors during the electrochemical classes she taught to student engineers of Grenoble INP, one of the major French educational centers, where electrochemistry is integrated as one of its major courses.

The rigorous but pedagogical approaches developed in this textbook will unquestionably provide its readers with a strong knowledge base. Yet in this case, «rigor» is not synonymous with «painful» or «nerdy». Indeed, the original presentation and the possibility of different reading levels will make this textbook accessible and pleasant to all, irrespective of their initial level. I have absolutely no doubt that students initiated and trained through clever use of this book will benefit from sound foundations upon which they will be able to build up the more specialized knowledge that they will acquire during either their follow-up studies or scientific careers.

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