Preface

Our motivation for writing this book was to provide materials scientists with a guide to the power and utility of atom probe microscopy, particularly, to atom probe tomography. We have sought to provide the beginner with a rigorous background, together with the practical information necessary to initiate successful experiments. Well-experienced practitioners should see this book as an up-to-date source containing complementary knowledge that supports and enables their research. A balance has been sought between providing a fundamental organisation of the main theories, a practical experimental guide and a source of valuable references.

For the past 20 years, atom probe techniques have been at the forefront of atomic-scale microscopy, producing unique atomically resolved tomographic maps of the distribution of the elements within small, but consistently increasing, volumes of material, and their use has markedly and steadily been expanding. We have, when possible or appropriate, discussed the complementarity of other atomic-resolution microscopy techniques. We have highlighted that atom probe microscopy provides unique insights into the structure and chemistry of a vast range of technological and scientific materials, ranging from steels for power plant applications to semiconducting nanoelectronics devices and, progressively, to organic and biological materials.

In several places in this book, we have directed the reader to various excellent textbooks that provide details of particular theories or practice that we have not treated. Over the last decade, the implementation of micro-electrode systems and wide-field-of-view detectors, along with the renaissance of pulsed-laser atom probe approaches, has transformed the capability of atom probe microscopy. This has brought the technique into the microscopy mainstream, and it is now widely recognised as a key enabler of materials science. We feel that this has generated the need for an up-to-date textbook that offers a framework for the many recent developments and focuses on instrumentation, experimental methods, tomographic reconstruction, data analysis and simulation.

Hamilton, ON, Canada — Baptiste Gault
Oxford, Oxon, UK — Michael P. Moody
Sydney, NSW, Australia — Julie M. Cairney
Sydney, NSW, Australia — Simon P. Ringer

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Gault, B.; Moody, M.P.; Cairney, J.M.; Ringer, S.P.

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