Preface

This book is an updated edition and sequel to a previous monograph *Atom-Probe Tomography*: *Analysis at the Atomic level* by M.K. Miller that was published by Kluwer Academic/Plenum Press (now Springer) in 2000 and includes some contributions from this previous edition. The now widely available local electrode atom probe, introduced in 2003, has resulted in major improvements in the acquisition rate, field-of-view, typical volume of the data acquired, and the various methods used to analyze the data, as well as expanding the range of materials that it is now possible to investigate, and the associated specimen preparation techniques.

This monograph is intended to provide an introduction to the technique of atom-probe tomography, and to its underlying theory. It presents the necessary background for students and researchers to successfully plan and execute atom-probe tomography experiments with the local electrode atom probe and to enable them to process the acquired data into useful and reliable information for their research.

A general introduction and overview of atom-probe tomography from a materials science perspective is presented in Chap. 1. The underlying theory, seen as part of high electric field nanoscience, is introduced in Chap. 2. This chapter includes aspects of the theory of charged surfaces, field adsorption, field ionization, post-field-ionization and field ion imaging, aspects of the thermodynamics of charged surfaces (based on the concept of an electrical Gibbs function), and relevant aspects of the charged-particle optics of field electron and ion emitters. Field evaporation, laser-specimen interactions, and related topics are discussed in Chap. 3. This chapter includes a much needed update and overview of basic field evaporation theory, and a summary overview of present understanding about the interaction of laser pulses with field electron and ion emitters. Details of the various methods for fabricating atom-probe tomography needle-shaped specimens by standard electropolishing and focused ion beams methods are discussed in Chap. 4. The components and operation of the state-of-the-art local electrode atom probe are documented in Chap. 5. The procedures used to acquire the ion-by-ion data, set the correct experimental conditions, interpret the raw data, and process the resulting solute distributions into compositional data, and three-dimensional visualizations are described in Chap. 6. The various standard methods used to statistically analyze the three-dimensional data to provide useful materials parameters are illustrated in Chap. 7.

Oak Ridge, TN, USA Michael K. Miller
Guildford, Surrey, UK Richard G. Forbes

Springer

http://www.springer.com/978-1-4899-7429-7

Atom-Probe Tomography
The Local Electrode Atom Probe
Miller, M.K.; Forbes, R.G.
2014, XVIII, 423 p. 182 illus., 62 illus. in color., Hardcover

ISBN: 978-1-4899-7429-7