APPLIED METALLOGRAPHY

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Edited by

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PREFACE

This book is a collection of articles written to provide the student, technician, engineer, or researcher with detailed information on the nature and application of a number of important metallographic techniques and subjects critical to physical metallurgy studies, materials development, and failure analyses. Consequently, this text should be a valuable extension to basic text books on light and electron microscopy because it emphasizes the application of these procedures as well as describes the basic methodology of their use.

The first five chapters describe important advanced metallographic techniques for revealing the microstructure of materials, usually selectively. For example, Vander Voort's chapter reviews the more traditional selective etching methods, whereas the other four are devoted to more specialized techniques. Stansbury reviews the technique of potentiostatic etching, which represents the ultimate in control of the etching process. Bühler and Aydin describe the interference layer method, perhaps the only universally applicable etching procedure. Gray describes the magnetic etching used to study domain structure and for revealing ferromagnetic phases in paramagnetic materials. Ondracek's chapter details the newly developed gas-contrasting technique, another procedure that employs interference effects.

Three other chapters deal with the use of metallographic techniques with specific materials—stainless steels, low-carbon free-machining steels, and titanium alloys—all very interesting subjects for the metallographer. Crouse and Leslie have reviewed procedures for revealing the structure of stainless steels, which, by the nature of their inherent corrosion resistance, are difficult to etch. Watson has prepared a comprehensive review that shows how microscopy is fostering the development of better free-machining steels, whereas Rhodes shows how vital mi-

croscopy has been in the development of titanium alloys.

Quantitative metallography, or stereology, has grown in importance substantially in the past three decades. DeHoff has prepared a review of basic measurement procedures and has shown how they are applied to generate meaningful data. Underwood's paper provides a comprehensive, up-to-date review of procedures for quantifying fracture features. Application of these techniques should produce further advances in our ability to control fractures.

Blau has written a review of microindentation hardness testing and shows that much more can be done with this technique than merely determining the hardness of materials.

Two chapters deal with electron metallographic techniques. In a mere two decades, the scanning electron microscope has become one of the most important metallographic tools for examining fractures and microstructures. A second chapter by Vander Voort demonstrates how natural and artificially produced contrast is used to reveal microstructures. Williams provides a detailed review of the scanning transmission electron microscope, perhaps the most powerful new tool for fine structure analysis.

Cross et al. have surveyed the use of metallography for the control of welding processes. Metallography has been the cornerstone of the development of strong, safe weldments.

Three chapters deal with the use of metallography in failure analysis. LeMay provides an overview of this important topic. Glaeser and White provide excellent detailed descriptions of the use of metallography for diagnosis of wear and corrosion failures, respectively.

GEORGE F. VANDER VOORT
Editor

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