Aluminum Alloy Castings
Properties, Processes, and Applications

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Preface

This book is intended to provide a comprehensive summary of the physical and mechanical properties of most types of aluminum alloy castings. It includes discussion of the factors that affect those properties, including composition, casting process, microstructure, soundness, heat treatment, and densification. Extensive previously unpublished technical data including aging response, growth, fatigue, and high- and low-temperature performance have been consolidated with existing and updated materials property characterizations to provide a single authoritative source for most performance evaluation and design needs.

The consideration of casting process technologies is intentionally limited to typical capabilities and to their influence on property performance. Many excellent references are available for more detailed information and guidance on production methods and on important aspects of melting, melt processing, solidification, and structure control. Interested readers are referred to the publications of the American Foundry Society (AFS), the North American Die Casting Association (NADCA), and the Non-Ferrous Founders’ Society (NFFS). Many of these publications are included in the reference lists at the end of each chapter.

It is also beyond the scope of this book to provide more than generalized economics of aluminum casting production.

The authors gratefully acknowledge the support and assistance of several organizations and individuals in developing this volume. Alcoa, Inc. generously provided extensive previously unpublished production and property data from their archives, adding significantly to the industry’s shared knowledge base. We wish, especially, to thank R.R. Sawtell and R.J. Bucci of Alcoa for their cooperation in arranging the release of this material. We are pleased that the American Foundry Society has been credited as co-publisher of this book. The AFS Aluminum Division Review Committee provided substantive and constructive suggestions; the members of the committee are listed in these pages. In addition, Laura Moreno and Joseph S. Santner of AFS provided content from AFS publications and arranged for the necessary permissions to reproduce information as needed. We would also like to thank Joseph C. Benedyk of the Illinois Institute of Technology for his helpful comments, and John C. Hebeisen of Bodycote for his assistance in providing the results of recent studies in hot isostatic processing. The North American Die Casting Association and the Non-Ferrous Founders’ Society also gave us permission to cite, with appropriate references, information from their publications. We also acknowledge the support and assistance of the Aluminum Association, Inc., notably, permission to include information from their publications covering aluminum casting alloys.

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About the Authors

J.G. (Gil) Kaufman has a background of almost fifty years in the aluminum and materials information industries and remains an active consultant in both areas. In 1997, he retired as vice president, technology, for the Aluminum Association, Inc., headquartered in Washington, D.C., and is currently president of his consulting company, Kaufman Associates. Earlier in his career, he spent twenty-six years with the Aluminum Company of America and five with ARCO Metals, where he was vice president, R&D. He also served as president and CEO of the National Materials Property Data Network, establishing a worldwide online network of more than twenty-five materials databases. Mr. Kaufman is a Fellow and Honorary Member of ASTM, and a Fellow and Life Member of ASM International. He has published more than 125 articles, including four books, on aluminum alloys and materials data systems.

Elwin Rooy retired after thirty-five years with the Aluminum Company of America, where he was corporate manager of metallurgy and quality assurance, to form a consulting firm specializing in aluminum process and product technologies, quality systems, and industry relations. He has been active in committees of the Aluminum Association, American Foundry Society, American Die Casting Institute, The Institute of Scrap Recycling Industries, Society of Die Casting Engineers, ASM International, and TMS. He has served as chairman of the TMS Aluminum Committee, chairman of the AFS Light and Reactive Metals Division, director and chairman of the Northeast Ohio chapter of AFS, regional director of the Foundry Education Foundation, and charter member of the Drexel/WPI Advanced Casting Research Laboratory. Mr. Rooy’s honors include the AFS award for Scientific Merit, The TMS/AIME Distinguished Service Award, the M.C. Flemings Award for contributions in the field of solidification, and the Arthur Vining Davis Award for technical achievement. He has served on the editorial boards of the Journal of Metals and Advanced Materials & Processes, published more than thirty articles and papers, edited Light Metals 1991, and authored or coauthored articles in the ASM Handbook series.
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