David R. Forester graduated in 1975 with a BA in Chemistry from Texas A&M University. Mr. Forester is the author or coauthor (editor) of approximately 800 publications including patents, technical papers, chapters, and books.

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Dr. Shah is an elected fellow of the Royal Society of Chemistry, which is typically awarded by one’s peers to signify a scientist’s high level of accomplishment. He has received a fellowship from the STLE in recognition of his outstanding contributions to the field of lubricants and tribology and he received his Fellow award at NLGI International for his work on greases. He has over 100 publications and was also a coeditor of the first edition of this book. He has received multiple awards from NLGI and also was a recipient of a distinguished award from the Institute of Chemical Technology.

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George E. Totten, Editor
Rajesh J. Shah and David R. Forester, Section Editors

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Foreword

Dedication

I am especially indebted to the continuing support of my wife, Alice Totten (George)

To Kian, who always inspires and taught me patience and gratitude (Raj)

To Lisa Drennen, for her countless hours of assistance with ASTM technical committee ballots, minutes, and standard documents, and for her unwavering support (David)

The editors also express their sincere appreciation to all the contributing authors and staff for the dedication and patience in providing their vital assistance in making this extensive work become a reality.
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Preface

The original objective of ASTM’s *Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing* was to provide an extensive, in-depth, well-referenced manual on fuels and lubricants. Although the primary focus of this handbook is on petroleum fluids, there is also coverage of nonpetroleum materials such as synthetic lubricants, vegetable oils, and ionic fluids when they may be used as functional alternatives to their petroleum counterparts.

The *ASTM Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing, First Edition* was published in 2003 and it contained 38 chapters. Although still widely used throughout the world as an internationally recognized standard reference text, after 15 years it was vital that it be updated. This was the primary goal of the current edition of the book. The chapters contained in *Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing, Second Edition* have been updated and, in most cases, rewritten. Furthermore, the addition of new chapters represents a significant increase in the breadth and depth of coverage, reflecting the continuing vital importance of petroleum technology. Topics covered in the 49 chapters contained in this book include an overview of general material production, fuels, lubricants, greases, nonpetroleum process fluids, ionic fluids, and testing.

With the revised and updated material, in addition to substantially expanded coverage, we expect that the *ASTM Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing, Second Edition* will continue its tradition as a prominent international academic and industrial reference.
George E. Totten received his BS and MS degrees from Pennsylvania State University, by New Jersey and his Ph.D. from New York University. Dr. Totten is past president of the International Federation for Heat Transfer and Surface Engineering (IHTSE) and is a fellow of ASM International, SME International, ASTM International, IHTSE and he is a Founding Fellow of AMME (World Academy of Materials and Manufacturing Engineering). Dr. Totten is a Professor at Portland State University, Portland, OR, and a visiting professor at the University of Sao Paulo in Sao Carlos, Brazil. He is also president of G.E. Totten & Associates LLC, a research and consulting firm specializing in Thermal Processing and Industrial Lubrication problems. Dr. Totten is the author or coauthor (editors) of approximately 800 publications including patents, technical papers, chapters and books.

David R. Forester serves Fuel Quality Assurance, Inc. as Global Products Development Manager. He has over 40 years experience in the fuel and refining industry, and has over 20 US patents on development of diesel and jet fuel additives, refinery catalysts, and other refinery and process related additives. He has designed, implemented and/or automated many fuel test methods, including many ASTM standards that have improved the quality of diesel and jet fuels. Mr. Forester has authored or coauthored many papers/presentations, and coauthored Mr. Forester has authored or coauthored many SAE and IASH papers/presentations, and coauthored Mr. Forester has authored or coauthored many SAE and IASH papers/presentations, and coauthored Dr. Shah is a Director at Koehler Instrument Company in Long Island, NY, where he has been working for the past 37 years. He holds a Bachelor’s degree in Chemical Engineering from the Institute of Chemical Technology (ICT), and a Ph.D. in Chemical Engineering from The Pennsylvania State University and a MCP degree in Marketing and Management from Long Island University. Dr. Shah has also been the director of being the only person to hold all 6 of these highly coveted certifications: CPC, TCH, Ceng, CSCh, CCCh, and CFPG, and the singular honor of being an elected Fellow of three professional organizations namely, STLE, NLGI, AIC, IHTSE and EI. Raj is a Certified Professional Chemist and Chemical Engineer with the National Certification Commission in Chemistry and Chemical Engineering. He has been awarded the Chartered Chemist status from the Science Council, UK, the Chartered Chemical Engineer from the Royal Society of Chemistry, and the Chartered Engineer status from the Engineering Council, UK.

Dr. Shah has recently confirmed the distinction of being a Chartered Petroleum Engineer from the Royal Society of Chemistry recognition of his specific expertise as a practitioner in energy engineering. Dr. Shah has also been a co-editor of the PMI standard from STLE and the Boltz Memorial Award from NLGI. Dr. Shah is an active member of ASTM, STLE, NLGI, SAE, AIC, ACS, SPE, IFT and AIOHE and is a member of several subcommittees in several of these organizations. He has been a co-convener for the ASTM Motor Oils Committee, and the ASTM Fuel Technology Committee. Raj is also a three-time recipient of the ASTM Award of Excellence and the ASTM Eagle Award from Committee D02. Dr. Shah is an elected fellow of the Royal Society of Chemistry, which is typically awarded by one’s peers to signify a scientist’s high level of accomplishment. He has over 40 years experience from the STLE. In recognition of his outstanding contributions to the field of lubricants and tribology he received the Fellows Award at NLGI International for his work on greases. He has over 200 publications and is also a contributor of the first edition of this book. He has received multiple awards from NLGI and is also a Founding Fellow of a scientific society from the Institute of Chemical Technology. Raj was recently confirmed on the Founders Board of Directors of Developmental Disabilities Institute, a school for autistic children on Long Island, and served on the NLGI board of directors for over 15 years. He is currently on the advisory board of The College of Engineering, Slowe University of New York, Stony Brook. The School of Engineering, Design, Technology and Professional programs (EDSTAP), Pennsylvania State University, and the Samuel Gio College of Engineering, Technology, and Lubrication Science Minor at Auburn University. Fluent in multiple languages, he enjoys kayaking, mixology, mobile photography and lives in Melville, NY, with his family.