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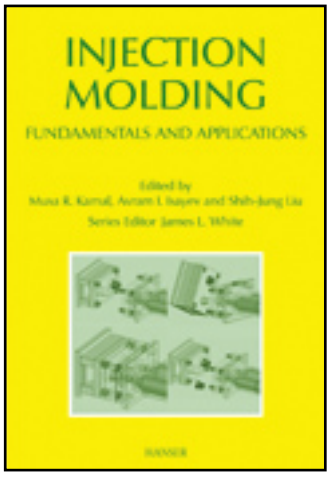

Preface

Injection Molding

Technology and Fundamentals

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Preface

The plastics industry has experienced phenomenal growth since the middle of the last century. The rates of growth of plastics production in most of the industrialized countries have experienced rates of growth that exceeded twice the rates of GDP growth. The use of plastics has penetrated a wide range of markets, replacing other materials and providing new concepts of material use and novel applications. Thus, one can find plastics in agricultural, construction, electrical and electronics, furniture, automotive, aerospace, biomedical, communications, packaging and other areas.

Many factors have contributed to the growth and success of the plastics industry. The most obvious factor is the fact that plastics are based on polymers. Polymers are versatile chemical macromolecules that can be tailored by manipulation of composition, molecular size and structure, by blending with each other or with simpler molecules to optimize their processing and performance characteristics. Polymers and plastics opened new frontiers in molecular and material design to satisfy socio-economic needs and requirements, at reasonable and competitive financial and energy costs.

While polymer synthesis provided desirable feedstocks to the plastics industry, it was necessary to invent and develop the transformation and processing technologies for converting the polymers into plastics products that meet market and application demands. Thus, calendaring, film blowing and casting, wire coating, compression and transfer molding, resin transfer molding, injection and blow molding, foam processing, and many other processes were invented, developed, or adapted to the needs of the plastics industry. Among all these plastics manufacturing technologies, injection molding has been the most dynamic and versatile. Injection molding can produce, with precision, 3-dimensional articles with complex shapes and intricate dimensions at repetitively high rates. The variety of products that may be obtained by injection molding include thermoplastics, thermosets, composites, nanocomposites, foams, blends, metals, ceramics, micro-parts and micro-patterns, and in-mold decorated or assembled complex products.

This book attempts to survey the state of the science and technology of the injection molding process. The authors of the 21 chapters in this book are experts and leaders in their respective areas of specialization in the injection molding field. While it is not possible to cover all aspects of such a dynamic growing field, we hope that the reader will find in this book sufficient information and background to become acquainted, at various levels of depth, with key components of the science and technology of injection molding.

The book is divided into five parts. The first part contains Chapter 1. It presents a general overview of plastics processing and injection molding, with emphasis on some of the important phenomena and technical issues associated with the application of the injection molding process and the general characteristics of injection molding products. The second part, including Chapters 2 to 6, deals with injection molding machinery and systems (machines and components, molding techniques, molds and plastication systems) and the different types of fluid assisted injection molding systems (gas and water assisted injection molding). Part III, including Chapters 7 to 10, deals with the processing and technical issues relevant

to the molding of complex materials systems, such as fiber reinforced composites, foams, metal powders, ceramics, and micro injection molding. In Part IV, which includes, techniques for process visualization, control and optimization (Chapters 11 to 13) are described It also provides some background on injection molding process simulation (Chapters 14 to16). Finally, in Part V (Chapters 17 to 21), experimental and simulation methods are described regarding microstructure development, characterization, and prediction of the effects of processing on microstructure development in crystalline and amorphous polymers and in one- and two-phase systems.

There are many people who contributed to the realization of this book. Firstly, we wish to express our sincerest thanks and appreciation to the contributors of the various chapters. Obviously, they have produced the bulk of the book. Then, it is impossible to thank all the people who provided help to us and to the individual chapter contributors, either directly or indirectly. Current and past students, researchers, chapter reviewers and professional colleagues are too numerous to name. We owe them a large amount of gratitude. We would like to express our appreciation for the efforts of Dr. Jorge Alonso Uribe-Calderon and Dr. Mohammad Al-Wohoush from McGill University in the harmonization of the text and graphics in the various chapters. Finally, the support, patience, and encouragement of our families, as well as the families of all the chapter contributors, have been critical for the success of this project. We dedicate this book to them.

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