

Preface

Polymers at cryogenic temperatures have become an important subject in polymer science and engineering, with new developments emerging in space, superconducting magnet, and electronic technologies, as well as large cryogenic engineering projects such as the International Thermonuclear Experimental Reactor (ITER). In this book, we define cryogenic temperatures as very low temperatures, such as liquid nitrogen (77 K), liquid hydrogen (20 K), and liquid helium (4 K) temperatures. To the best of our knowledge, only a few books have been published on the cryogenic properties of polymers. There has been great progress in the past four decades in this field and this book summarizes the developments so far. Twelve chapters cover various topics within this subject.

In Chap. 1, state of the art, advantages and applications for cryogenic processing are briefly surveyed. Cryogenic mechanical and physical properties of polymers and polymer nanocomposites are reviewed in Chap. 2. Chapter 3 covers the friction and wear of polymeric materials at cryogenic temperatures. This chapter gives an overview of theories and experimental studies on polymer tribology at cryogenic temperatures. Mechanical behavior of polymer composites at cryogenic temperatures is explained in Chap. 4. Chapter 5 describes the studies on the interlaminar delamination fracture and fatigue of woven glass fiber-reinforced polymer composite laminates under Mode I, Mode II, and Mode III loadings at cryogenic temperatures. Chapters 6 and 8 present the behavior of polymer-based dielectrics under cryogenic conditions. Medical applications of cryo-treated polymeric hydrogels such as poly(vinyl alcohol) cryogels are covered in Chap. 7 of this book. Chapter 9 addresses the effect of cryogenic treatment on mechanical behavior of glass fiber-reinforced plastic composite laminate. Chapter 10 covers the polyurethane and polyisocyanurate foams in external tank cryogenic insulation. Chapter 11 includes the effect of the cryogenic treatment on cutting tools and polymers. Finally, current and potential applications of cryogenic-treated polymers are covered in Chap. 12.

Since this book covers all topics related to cryogenic treatment, properties of polymers at cryogenic temperatures, and applications of cryo-treated polymer

materials, we hope that it will be of interest to the academic and industrial research community.

Susheel Kalia would like to thank his students, who helped him in the editorial work. Shao-Yun Fu wishes to thank Technical Institute of Physics and Chemistry, Chinese Academy of Sciences for the opportunity to work on this subject. Financial support from the National Science Foundation of China and the Chinese Academy of Sciences is greatly appreciated. Finally, we gratefully acknowledge permissions to reproduce copyrighted materials from a number of sources.

The editors would like to express their gratitude to all contributors of this book, who have provided excellent contributions.

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Polymers at Cryogenic Temperatures

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2013, VIII, 292 p., Hardcover

ISBN: 978-3-642-35334-5