

# Preface

In the past 30 years, only few polymers, that have been developed, are able to reach the commercial stage. Polybenzoxazines are one of those few. Their ease of synthesis with tremendous molecular design flexibility allows tailor-made properties with a broad range of applications. Their unique characteristics such as self-polymerizability upon heating without a need for a catalyst or curing agent, very low A-stage viscosity, near-zero volumetric shrinkage, fire resistant behaviors, as well as their outstanding thermal and mechanical properties make the polymer highly attractive for various applications including electronic packaging or aerospace.

Demand for high performance multicomponent polymeric materials based on existing polymers continues to be increasingly important from stringent requirements from a variety of industrial sectors. This book provides an introduction to the unique and fascinating properties of alloys and composites from novel commercialized thermosetting resins based on polybenzoxazines. Their outstanding properties such as processability, thermal, mechanical, electrical properties, as well as ballistic impact properties of polybenzoxazine alloys and composites are discussed and reviewed in the monograph. [Chapter 1](#) of this book presents an introduction to major and commercially available benzoxazine resins, their commercialized polymeric products, and their outstanding properties. [Chapter 2](#) presents major alloy systems based on polybenzoxazines and some synergistic behaviors observed in these alloys, whereas [Chap. 3](#) discusses the fundamentals of highly filled polybenzoxazine composite systems that render, e.g., very high thermomechanical and thermophysical composite materials. High thermal conductivity of filled polymers is one essential property desired for an application such as electronic packaging encapsulation and very high thermally conducting polybenzoxazine composites for such applications will be discussed in [Chap. 4](#). [Chapter 5](#) summarizes natural fiber-reinforced polybenzoxazine composites as a newly high performance wood-substituted material from the ability of polybenzoxazines to strongly adhere to lignocelulosic materials. An ability of polybenzoxazines to form polymer alloys with various types of other resins or polymers are demonstrated in [Chap. 6](#) on their applications as lightweight ballistic composites with high performance fibers such as Kevlar<sup>TM</sup>. The last chapter of this book presents electrical properties of filled polybenzoxazine composites with those

conductive fillers such as carbon black and graphite. The composites are investigated for promising applications such as a bipolar plate in fuel cell, etc. Although [Chap. 2](#) and part of [Chap. 4](#) resemble original research articles, the information from these chapters is up-to-date and highly cited by researchers and thus worthy to be included in this book.

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Alloys and Composites of Polybenzoxazines

Properties and Applications

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