

Optical Microscopy of Fiber-Reinforced Composites

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Preface

This book is designed as an instructional reference for preparing fiber-reinforced polymeric-matrix composite materials for examination by optical microscopy and the techniques of optical microscopy used for analysis. It is also meant to be a teaching tool for those who want to learn more about the microstructure of these heterogeneous and anisotropic materials. The content is also appropriate for experienced microscopists or metallurgists who become involved in the preparation and analysis of polymeric composites. This book begins with an introduction to fiber-reinforced polymer-matrix composite materials that focuses on the microstructure and morphology of these unique materials. In the following chapters, the authors explain the materials, equipment, and procedures of how to prepare composite samples, followed by the illumination and contrast techniques of optical microscopy. Included in these chapters are the methods and reagents that are used to bring out distinct features in composite materials, such as different phases and areas of degradation or damage. Also included are details of how to prepare special composite materials having vast differences in hardness and material properties. The remaining chapters present various topics of studies of fiber-reinforced polymeric composite materials that have been performed by using optical microscopy.

These studies include a majority of the microstructural information that is of primary interest when working with composite materials. Insight into processing effects, toughening approaches, damage mechanisms, and environmental effects on the microstructure of composite materials is presented. Through these chapters and the micrographs throughout this book, it will be evident that optical microscopy is one of the most valuable tools for analyzing fiber-reinforced polymeric-matrix composites. Unfortunately, with all of the nonoptical methods of analysis available today, optical microscopy is often overlooked or not used to the fullest extent. The contents of this book were developed after many years of the authors presenting on this subject and teaching short courses about optical microscopy of composite materials. It is hoped that this text is found useful to everyone who desires to further increase their knowledge of optical microscopy and the microstructure of fiber-reinforced polymeric composite materials.

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