

**MOLECULAR CHARACTERIZATION
OF COMPOSITE INTERFACES**

POLYMER SCIENCE AND TECHNOLOGY

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Edited by

Hatsuo Ishida

*Case Western Reserve University
Cleveland, Ohio*

and

Ganesh Kumar

*Vistakon Inc. (a Johnson & Johnson Company)
Jacksonville, Florida*

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PREFACE

This book is an extended version of the proceedings of the Symposium on Polymer Composites, Interfaces, which was held under the auspices of the Division of Polymer Chemistry, American Chemical Society (ACS) during the annual ACS meeting in Seattle, March, 1983.

The importance of the interface in composite materials has been recognized since the inception of modern composite technology. Specifically, silane coupling agents were developed for glass fiber reinforced composites at a very early date. Ever since then the diversity of composite materials and the development of various surface treatment methods have led to the establishment of an "interface art." A trial-and-error approach has dominated the interfacial aspects of composite technology until very recently. With the advent of modern analytical techniques for surface characterization, it became possible to study detailed surface and interface structures.

It was hoped that this symposium would catalyze such a fundamental and scientific approach in composite studies. For this reason, the symposium was structured to verify the influence of interfacial structures on the mechanical and physical performance of composites and to improve our knowledge of the microstructure of composite interfaces. As the word "composite" indicates, interdisciplinary interaction is indispensable for proper understanding of multiphase systems.

The symposium consisted of four sessions each of which is represented by the titles in Part II through Part V. However, in order to provide a rather in depth introduction to the field, some papers are rearranged into Part I, general overviews. All papers are reviewed by leading scientists in this field with standards similar to those of well-respected journals. The rest of this volume is divided into: Part II. Influence on Physical Properties; Part III. Structure of Coupling Agents and Interfaces; Part IV. Influence on Matrix Structure; and Part V.

Surfaces of Reinforcements. These divisions are instrumental in identifying the dominant structural factors. True understanding of the role of the interface, however, must come from an intricate combination of the findings made for each region.

This book is an important addition to the field since little has been written on the subject. It should be useful for those who want to manufacture more reproducible and reliable composites. For beginners, this may provide a milestone as the book represents the forefront of the field. The book discusses composites made of glass fibers, carbon fibers, organic fibers and particulate fillers. Characterization techniques include FT-IR, NMR, ESCA, ESR, SIMS, emission, microbalance and others. It is tempting to imagine that the knowledge accumulated with all these techniques will soon be used to control and tailor the interfacial structures required for specific composite properties.

No book is complete without making proper acknowledgement to those deserving it. We are grateful to the Polymer Chemistry Division and ACS for encouraging us to organize the symposium. Anonymous reviewers are the judge of high standards. Their hidden effort and help must be highly praised. Special thanks are due to Mr. R.T.Graf, S.R.Culler and J.D.Miller for careful proof reading of many of the manuscripts. We are very thankful for Ms. D.Waldron for typing the manuscripts in spite of the heart-breaking tragedy in her family during the entire period of the preparation of this book. Many thanks are also due to the interest in our project and the patience of Mr. P.J.Alvarez of Plenum Publishing Co. Whole-hearted support of our family members is always special to us. We wish that someday our children will advance beyond this milestone. As long as this book remains, the authors' commitment in their scientific pursuit will be remembered. Their cooperation and encouragement are gratefully acknowledged.

H.Ishida

Department of Macromolecular Science
Case Western Reserve University
Cleveland, Ohio 44106

G.Kumar

Vistacon Inc.
P.O.Box 10157
Jacksonville, Florida 32247

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