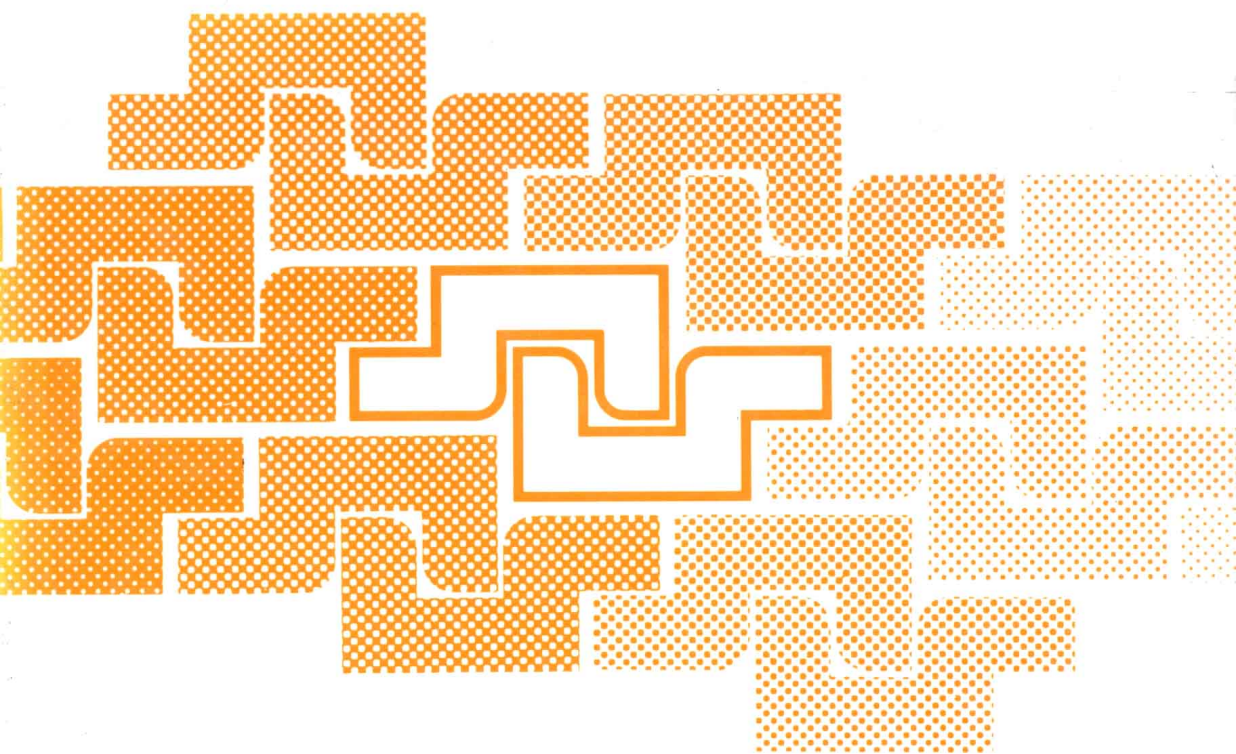




Structure Development During Polymer Processing

Edited by

A.M. Cunha and S. Fakirov

NATO Science Series

Series E: Applied Sciences – Vol. 370

Proceedings of the NATO Advanced Study Institute on
Structure Development in Processing for Polymer Property Enhancement
17-28 May 1999
Caminha, Portugal

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 0-7923-6449-X

Published by Kluwer Academic Publishers,
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.

Sold and distributed in North, Central and South America
by Kluwer Academic Publishers,
101 Philip Drive, Norwell, MA 02061, U.S.A.

In all other countries, sold and distributed
by Kluwer Academic Publishers,
P.O. Box 322, 3300 AH Dordrecht. The Netherlands.

Printed on acid-free paper

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Printed in the Netherlands.

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PREFACE

30 years ago, polymer processing was considered to be a set of operations aiming at imparting a desired shape to the material, while its final properties were defined exclusively by the molecular structure and architecture resulted from the respective synthetic approaches. These two fields of knowledge — polymer processing and polymer structure — grew closer as several scientific and technological works disclosed the microstructure and other morphological features developed by polymeric systems upon different processing conditions.

Even before the real understanding of the polymer structural details, engineers were able to make use of the effect of molecular orientation and to manufacture polymeric fibres with enhanced properties in terms of stiffness and strength. However, it was during the 1970s that the scientific community started to relate microstructure development and the thermomechanical environment associated to different processing techniques. Ever since, very important works were done on semicrystalline, amorphous or blended polymers in order to identify and, recently, to predict the effect of the imposed shear fields and cooling gradients on the final product properties. These efforts led to more accurate processing methods and stimulated new engineering approaches, such as property enhancement through out-of-the-processing as well as on-line control. Modern processing technology has developed further towards the nano level, enabling impacts on the macromolecular structure.

It is the actual framework for new perspectives and new insights into modern polymer processing, that should not be regarded as a simple shape-converting operation anymore, but as a route to the achievement of specific properties of a given system, involving substantial reorganization processes on a molecular level.

These consideration were the scientific and technological motivation for the organization of the NATO-ASI *Structure Development in Processing for Polymer Property Enhancement* that gathered a group of almost 90 scientists from around the world in Caminha (Portugal), in 1999 (May 17–28). The main objective was to review, in a tutorial and comprehensive manner, the recent scientific knowledge and R&D achievements in the fields of the interrelationships between properties, structure and processing of polymeric materials.

This book contains the majority of the contributions of faculty members to that ASI, which are organized in three sections: (i) Structure and Properties, (ii) Structure Development During Processing, and (iii) Structure Development in Blends and Composites.

In comparison to the previous traditional publications, a peculiarity of this one is that

due to the initiative of the Editors, generously supported by the Publisher and by the Contributors, an attempt was made to approach it to a monograph (with respect to both the graphical presentation and the scientific content, also reducing the volume) rather than to the common Conference Proceedings of a meeting. To what extent these joint efforts were successful will be judged by the readers.

Aside from this publication, the Caminha NATO-ASI has enabled intensive scientific discussions among scientists with different backgrounds, experiences, perspectives, age, and origins, promoting contacts that should lead to new cooperations in the near future.

The success of this initiative was possible mainly due to the support of the NATO Scientific Affairs Division both in the organization of the ASI and in the preparation of this book. The ASI was also partially supported by local Portuguese institutions, such as Fundação para a Ciência e Tecnologia, Universidade do Minho, Câmara Municipal de Caminha, Câmara Municipal de Monção, Câmara Municipal de Melgaço and Comissão de Turismo do Alto Minho.

The Editors and the participants greatly appreciate the sponsorship of the NATO Advanced Study Institutes Programme and the financial aid by other sponsors, as well as the cooperation of the University of Minho staff and associate research members, who assured the organization logistics.

Last but not least, the Editors would like to stress that they enjoyed the work with individual Contributors and to thank them for their patience, understanding and support, as well as for the preparation of manuscripts, differing substantially from their presentations during the ASI.

António M. Cunha,
Stoyko Fakirov
Editors

Guimarães, January, 2000

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Part I

STRUCTURE AND PROPERTIES

