POLYMER SCIENCE AND TECHNOLOGY
Volume 10

POLYMER ALLOYS

Blends, Blocks, Grafts, and
Interpenetrating Networks

POLYMER SCIENCE AND TECHNOLOGY

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Edited by Daniel Klempner and Kurt C. Frisch

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Daniel Klemppner
and Kurt C. Frisch

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PREFACE

Alloy is a term commonly associated with metals and implies a composite which may be single phase (solid solution) or heterophase. Whichever the case, metallic alloys generally exist because they exhibit improved properties over the base metal. There are numerous types of metallic alloys, including interstitial solid solutions, substitutional solid solutions, and multiphase combinations of these with intermetallic compounds, valency compounds, electron compounds, etc. A similar situation exists with polymers. There are numerous types of composites, or "alloys" of polymers in existence today with new ones being created continuously. Polyblends are simple physical mixtures of the constituent polymers with no covalent bonds occurring between them. As with metals, these may be homogeneous (single phase) solid solutions or heterogeneous (multiple phase) mixtures. With polymers, the latter case is by far the most prevalent situation due to the thermodynamic incompatibility of most polymers. This is due to the relatively small gain in entropy upon mixing the polymers due to contiguity restrictions imposed by their large chain length. If the component polymers in the blend are crosslinked, a relatively new situation arises. The resulting material is known as an interpenetrating polymer network (IPN). IPN's represent a mode of blending two or more crosslinked polymers to produce a mixture in which phase separation is not as extensive as would be otherwise, due to "permanent" entanglements occurring between the networks. If covalent bonds exist between the component polymers, a graft copolymer results. The term graft is employed since these copolymers (and they are true copolymers since the polymers are covalently bonded to each other) are generally produced by "grafting" a growing chain of one polymer onto a chain of another polymer. If the differing monomer units are arranged linearly in segments covalently bonded

to one another along the chain, a block copolymer results. Phase separation generally occurs with the latter types of polymer composites, although it is not as extensive as in the case of polyblends.

As with metals these "polymer alloys" generally exhibit enhanced and in many cases synergistic properties. Indeed, this is the major impetus for their formation. Determination of the morphology of these composites has presented a unique challenge to polymer scientists and engineers. This book presents a compilation of the most recent efforts of both American and foreign scientists in one of the most active areas of polymer research today, the study of the preparation, characterization, and properties of polymer alloys. The major portion of the chapters in this book was presented at a symposium sponsored by the Division of Organic Coatings and Plastics Chemistry at the 173rd meeting of the American Chemical Society, held in New Orleans in March, 1977.

The editors wish to express their gratitude to the numerous authors who contributed to this book and to the University of Detroit for its encouragement of this effort.

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