

book reviews

Electrical Degradation and Breakdown in Polymers

L. A. Dissado and C. J. Fothergill

The Institution of Electrical Engineers, Stevenage, 1992, £65.00

ISBN 0 86341 196 7

One of the most important properties of polymeric materials from a technological point of view has been their electrical insulation characteristics. Over the last 30 years polymeric materials have been increasingly used for a wide variety of electrical insulation problems and the effects of longterm ageing has become a topic of both academic and industrial importance. This book attempts to provide a comprehensive survey of the problems associated with electrical tree and water tree degradation in polymeric insulators.

The book is divided into five parts. The first part, 'Introduction to Polymers and Electrical Breakdown', contains three chapters which provide an elementary introduction to polymer structure and morphology, polymers as wide band-gap insulators and an overview of electrical degradation and breakdown. The second part of the book deals specifically with treeing degradation in polymers and, more specifically, with water treeing and electrical tree degradation. Part three, 'Deterministic Mechanisms of Breakdown', reviews what is known about charge injection and transport, thermal and electromechanical breakdown. Part four deals with the stochastic nature of breakdown and considers the various ways in which theories may be formulated to predict the types of structure generated during the various forms of breakdown observed in polymeric materials. Part five is concerned with engineering for breakdown testing and degradation assessment and is concerned with the practical issues relating to failure in polymeric materials.

The text contains 939 references and is perhaps the most comprehensive discussion of the problem of electrical breakdown currently in existence. This book can be highly recommended for anyone who has the practical problem of understanding breakdown. It is a very thoughtful and analytical discussion of the problem which raises many academic questions and which hopefully may be

addressed by those interested in research in this area. The book is well written and laid out in a way that allows the reader to find easily discussion of particular aspects of the subject from the well organized index.

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Polymer Solutions, Blends, and Interfaces

I. Noda and D. N. Rubingh (Eds)

Elsevier Science Publishers BV,

Amsterdam, 1992, 485 pages,

US\$ 225.00

ISBN 0-444-89397-0

This volume is number 11 in a series 'Studies in Polymer Science' but appears to cover a wider topic range than most of the other contributions to the series. This is mainly due to the fact that it comprises a collection of papers presented at a Proctor and Gamble sponsored symposium, held at the ACS Meeting in New York in August 1991. The result is that the topic range covered is extensive and not easily inter-related which means most readers will only wish to dip into the subject matter here and there where it is of particular interest to them.

There are 23 papers which can be loosely grouped under the following headings: Surface and Interfacial Effects (seven papers), Polymer Blends and Liquid Crystal Blends (seven papers), Polymer Chain Dynamics (three papers), while the remaining six papers cover areas such as adhesion, membrane porosity control, composite conductive polymers, polyelectrolyte titration, aggregation, and block copolymer synthesis and morphology.

Consequently it is difficult to review this book effectively without giving a detailed list of the contents. There are a number of interesting papers in the blends and liquid crystal group. The use of supercritical solutions to produce non-equilibrium one-phase blends from thermodynamically immiscible polymers by a rapid expansion technique is a novel approach to the preparation of new materials and is described by Shine *et al.*

Some work on lyotropic polysaccharide liquid crystal blends is presented by Spontak *et al.*, while Earman *et al.* illustrate new orientation techniques for making high performance materials from semi-flexible polymers including some cellulose-based materials. The latter authors also present a theoretical treatment of the observed discontinuity in the stress-strain behaviour of liquid crystalline polymer networks arising from a nematic-isotropic transition. Polymer dispersed liquid crystal display devices are of recent interest but their performance is dependent on the size and behaviour of the dispersed droplets of liquid crystals. Kyu *et al.* describe the application of phase separation methods to produce good uniform dispersions.

The papers by Noda on surface hydrophilic elastomers and Schechtman on emulsion polymerization are also of general interest, but these highlights may simply reflect my own preferences and this sums up the nature of this book; it is for browsing through in the library. I do not recommend purchase of a personal copy, particularly in view of the price; indeed with limited library budgets I would place this low on my shopping list.

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Polymeric Surfactants

I. Piirma

Marcel Dekker, Inc., New York, 1992, 304 pages, \$125.00 (USA and Canada); \$143.75 (all other countries)

The name 'Polymeric surfactant' conjures up so many possible functions and structures, that one is sometimes reluctant to use it, except in discussions where it can be an advantage to blur the meaning of what is said. The great value of this book is that it goes quite a long way in illustrating these structures and functions, thus giving more cohesion to the term.

The aim of the author is indeed to provide a broad introduction to the world of polymeric surfactants, and in this she succeeds very well. The many facets of the subject each have a number of detailed books and articles on them, but it is a

somewhat daunting task for a newcomer to get an overall picture — here we now have the benefit of someone who has had a lifetime's familiarity with both the fundamental side and the application of polymeric surfactants to solve problems.

The term 'surfactant' (or surface active agent) implies a material that will function at some interface, and the multisegment nature of polymers often makes them very efficient adsorbing species. Thus the first part of the book covers the solution and adsorption behaviour of polymers, their effects on the stability of dispersions and methods for synthesizing polymers that can function as surfactants. The second and more important part of the book is mainly concerned with their application in aqueous and non-aqueous systems, especially during polymerization reactions. Application of polymeric surfactants in solid/liquid dispersions is largely omitted, there being already a wealth of articles and books covering that area.

The first chapter provides a simple overview of the effects of polymers on colloid stability, with sufficient references to delve deeper into the subject. The next two chapters illustrate routes to making block and graft copolymers, again with enough references to go further on the subject. After a brief chapter on the solution and adsorption properties of block copolymers, the book gets to its main focus, which is the use of polymeric surfactants in practical processes, especially during polymerization. Polyester copolymers and poly(vinyl alcohol) are commonly used in emulsion polymerization and examples of the numerous possible grafting and stabilizing interactions are described in Chapters 5, 6 and 7. Chapter 8 deals with polymer blends, and the application of copolymers to changing phase separation boundaries (and, of course, the physical properties of the blends). The following chapter also deals with polymers in organic media and covers dispersion polymerization, or

polymerization where the polymer is insoluble in the continuous phase. Here copolymers can act to stabilize growing polymer particles and change the processing and properties of the final products. The final two chapters return to aqueous-based systems, dealing with the use of ionizable comonomers to stabilize latices and polymerization in microemulsions.

Throughout, the book is well written and easily understood; the diagrams are clearly reproduced and each chapter gives sufficient references to get deeper into the subject. Thus the author succeeds in her aim of providing an introduction to the subject of polymeric surfactants, that will be of considerable benefit for those researchers wanting to know if these materials can be of any practical use in solving problems.

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