

Degradation of polymers

Polymers can degrade by exposure to

high temperature

Shear action

Oxygen, ozone and chemicals

Electromagnetic (γ , UV)

Ultrasonic radiation

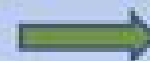
Moisture



Thermal Degradation



Mechanical Degradation



Chemical Degradation



Light induced Degradation



Hydrolysis

Polymer Degradation

Norman Grassie, Gerald Scott



Polymer Degradation:

Polymer Degradation and Stabilisation Norman Grassie, Gerald Scott, 1988-04-14 The study of polymer degradation and stabilisation is of considerable practical importance as the industrial uses of polymeric materials continue to expand In this book the authors lucidly relate technological phenomena to the chemistry and physics of degradation and stabilisation processes Degradation embraces a variety of technologically important phenomena ranging from relatively low temperature processes such as weathering of plastics fatigue of rubbers through the processing of polymers in shearing mixers to very high temperature processes such as flammability and ablation All these technological phenomena have in common certain basic chemical reactions Thus weathering has its roots in photo oxidation fatigue and melt degradation in mechano oxidation and flammability and ablation in ablation in pyrolysis and vapour phase oxidation Handbook of Polymer Degradation S.

Halim Hamid, Mohamed B. Amin, Ali G. Maadhah, 1992 This useful reference provides up to date coverage from both the engineering and scientific viewpoints of the most recent findings in the expanding field of polymer degradation and stabilization including areas in which polymers have only recently been used and detailed information has not previously been available as advanced material for more in depth study Handbook of Polymer Degradation introduces new data on the effects of increased UV radiation on polymers and discusses how to decrease those effects considers artificially accelerated weathering and its relationship with natural weather examines weathering degradation of polyethylene with the relevant experimental results emphasizes the environmental aspects and waste management of polymers and combines insights on the environmental toxicology of plastics with a survey of current legislative issues different parts of the world Handbook of Polymer Degradation is an essential reference for chemical polymer environmental pollution control mechanical and materials scientists and engineers chemists environmental regulators and policy makers and upper level undergraduate and graduate students in these disciplines **Fundamentals of Polymer Degradation and Stabilization** N.S. Allen, M.

Edge, 1992-10-31 During the past decade the field of polymer degradation and stabilization has become a subject of central importance in polymer science and technology This book provides a fundamental source of information designed for those with only a basic understanding of the background of the field Elements of Polymer Degradation Leo Reich, Salvatore S.

Stivala, 1971 **Polymer Degradation Mechanisms** United States. National Bureau of Standards, 1953 Chemical Physics of Polymer Degradation And Stabilization N. Nikolai Markovich Emanuel', Anatoliĭ Leonidovich Buchachenko, 1987-06

Polymer Degradation and Stabilization W. L. Hawkins, 2012-12-06 The development of polymers as an important class of material was inhibited at the first by the premature failure of these versatile compounds in many applications The deterioration of important properties of both natural and synthetic polymers is the result of irreversible changes in composition and structure of polymers molecules As a result of these reactions mechanical electrical and or aesthetic properties are degraded beyond acceptable limits It is now generally recognized that stabilization against degradation is

necessary if the useful life of polymers is to be extended sufficiently to meet design requirements for long term applications. Polymers degrade by a wide variety of mechanisms several of which affect all polymers through to varying degree. This monograph will concentrate on those degradation mechanisms which result from reactions of polymers with oxygen in its various forms and which are accelerated by heat and or radiation. Those stabilization mechanisms are discussed which are based on an understanding of degradation reaction mechanisms that are reasonably well established. The stabilization of polymers is still undergoing a transition from an art to a science as mechanisms of degradation become more fully developed. A scientific approach to stabilization can only be approached when there is an understanding of the reactions that lead to degradation. Stabilization against biodegradation and burning will not be discussed since there is not a clear understanding of how polymers degrade under these conditions.

Polymer Degradation W. Schnabel, 1981-12-31 No detailed description available for Polymer Degradation

Handbook of Polymer Degradation S. Halim Hamid, 2000-06-30 Covers recent advances in polymer degradation and stabilization. Focuses on the basics of photo and bio degradability. Delineates special and general environmental parameters such as solar irradiation temperature and agrochemical exposure. Surveys plastic waste disposal strategies such as recycling incineration chemical recovery by pyrolysis and source reduction.

Progress in Polymer Degradation and Stability Research Herbert W. Moeller, 2007-06-11 Polymer degradation is a change in the properties tensile strength colour shape etc of a polymer or polymer based product under the influence of one or more environmental factors such as heat light or chemicals. These changes may be undesirable such as changes during use or desirable as in biodegradation or deliberately lowering the molecular weight of a polymer. Such changes occur primarily because of the effect of these factors on the chemical composition of the polymer. In a finished product such a change is to be prevented or delayed. However the degradation process can be useful from the view points of understanding the structure of a polymer or recycling reusing the polymer waste to prevent or reduce environmental pollution. Polymers molecules are very large on the molecular scale which derive their unique and useful properties from their size.

Encyclopedia of Polymer Degradation George Wypych, 2025-01-23 Encyclopedia of Polymer Degradation compiles research results for the most important and commonly used polymers identifying their unitary degradative chemical reactions including the fate of products resulting from primary degradation which can influence further degradation mechanisms and rates. The book proposes potential mechanisms of reactions and chemical descriptions of the sequence for events for each degradation mode. It takes a knowledge based approach with the aim of facilitating more effective prevention of waste and environmental pollution caused by material failures and also discusses the limitations of typical weathering studies challenges in lab based weathering studies and the importance of understanding various degradation mechanisms. Outlines the limitations of typical weathering studies considering how they take place in natural outdoor environments where conditions aren't controlled and discussing how these limitations can be effectively dealt with. Covers challenges in laboratory weathering studies and how

these can be overcome Emphasizes the importance of understanding degradation mechanisms enabling the selection of the most resistant materials for specific applications and the development of effective stabilization strategies to protect materials against degradation **Chemistry of High Polymer Degradation Processes** Norman Grassie,1956 **The Effects of**

Polymer Degradation on Flow Properties of Fluids and Lubricants Containing Polymers ,1965 Thermal Degradation of Polymeric Materials Krzysztof Pielichowski,James Njuguna,2005 Understanding the thermal degradation of polymers is of paramount importance for developing a rational technology of polymer processing and higher temperature applications Controlling degradation requires understanding of many different phenomena including chemical mechanisms the influence of polymer morphology the complexities of oxidation chemistry and the effects of stabilisers fillers and other additives This book offers a wealth of information for polymer researchers and processors requiring an understanding of the implications of thermal degradation on material and product performance **Developments in Polymer Degradation—7**

N. Grassie,2012-12-06 The purpose of this volume like that of its predecessors in the series is to present a selection of topics which are representative of the continually expanding area of polymer degradation It will be obvious that some of these topics emanate from academic studies others from more applied backgrounds but it is anticipated that all will be seen to be of vital relevance to one or other of the currently advancing fields of polymer technology The first two chapters deal with specific classes of polymers and particularly with their mechanisms and products of thermal degradation Thus in Chapter 1 Dr McNeill discusses the reactions of the ammonium alkali and alkaline earth metal salts of poly methacrylic acid and their copolymers with methyl methacrylate These water soluble ionomers have valuable technological applications In Chapter 2 Professor Montaudo and Dr Puglisi perform a valuable service by drawing together and critically reviewing for the first time to my knowledge the mechanisms of thermal degradation of the various classes of condensation polymers which are of industrial significance This includes for example the polyurethanes polyureas polyesters polycarbonates polyamides polyimides polyethers polysulphides polysulphones polyschiff bases polysiloxanes and polyphosphazenes

Polymer Degradation Wolfram Schnabel,1981 Developments in Polymer Degradation Norman Grassie,1987 *Photodegradation of Polymers* Jan F. Rabek,2012-12-06 In this book on physical characteristics and practical aspects of polymer photodegradation Rabek emphasizes the experimental work on the subject The most important feature of the book is the physical interpretation of polymer degradation e g mechanism of UV light absorption formation of excited states energy transfer mechanism kinetics dependence on physical properties of macromolecules and polymer matrices formation of mechanical defects practics during environmental ageing He includes also some aspects of polymer photodegradation in environmental and space condition **Polymer Degradation and Stabilization** W. Lincoln Hawkins,1984 Polymer Degradation and Performance American Chemical Society. Meeting,2009 This book focuses on the current scientific trends in polymer material property optimization and degradation with an emphasis on lifetime prediction and reliability and new

avenues for the design of materials and bio polymers with improved performance

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