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1: Crystallization Process Systems - PDF Free Download

Chapter 4: Packing and Selling Everything We Own By littlehouseonthewater February 1, During dinner for the past few months, our family has been inspired by several other families who had sold everything, bought a mono-hull sailboat and vlogged their adventures.

 Subject index Preface Crystallization from solution is a core technology in major sectors of the chemical process and allied industries. Crystals are produced in varying sizes ranging from as small as a few tens of nanometers to several millimetres or more, both as discrete particles and as structured agglomerates. Wellestablished examples include bulk and fine chemicals and their intermediates, such as common salt, sodium carbonate, zeolite catalysts and absorbents, ceramic and polyester pre-cursors, detergents, fertilizers, foodstuffs, pharmaceuticals and pigments. Applications that are more recent include crystalline materials and substances for electronics devices, healthcare products, and a wide variety of speciality applications. Thus, the tonnage and variety of particulate crystal products worldwide is enormous, amounting to about half the output of the modern chemical industry. The economic value, social benefit and technical sophistication of crystal products and processes are ever increasing, particularly in the newer high added value sectors of global markets. This places yet greater demands on the knowledge, skill and ingenuity of the scientist and engineer to form novel materials of the required product characteristics and to devise viable process engineering schemes for their manufacture. Thus, the unit operation of crystallization is normally only part of a wider processing system. Attention to the latter rather than the former can result in a simpler, cheaper and more robust solution. Similarly, the scale of crystallizer operation can have a large effect on crystal product characteristics and hence their subsequent separation requirements. Previously a largely empirical art, the design of process systems for manufacturing particulate crystals has now begun to be put on a rational basis and the more complex precipitation processes whereby crystallization follows fast chemical reactions have been analysed more deeply. This progress has been aided by the growing power of the population balance and kinetic models, computational fluid dynamics, and mixing theory. This not only increases understanding of existing processes but also enhances the possibility of innovative product and process designs, and speedier times to market. Several large gaps in knowledge remain to be filled, however, thereby providing opportunities for further research. This perspective gives the reason for writing the book, and provides its theme. The focus of the book, however, is on crystallization; only dealing with related unit operations as far as is necessary. The work is presented initially at an introductory level together with examples while later providing a window into the details of more advanced and research topics. Particular attention is paid both to the fundamental mechanisms and the formulation of computer aided mathematical methods, whilst emphasizing throughout the continuing need for careful yet efficient practical experimentation to collect basic data; the latter being essential in order to discriminate between competing theories, to inform and validate process models, and to discover the unexpected. To these is added the results of several research projects. Consequently, the book is aimed equally at students, researchers and practitioners in industry, particularly chemical engineers, process chemists and materials scientists. The book is divided into 9 chapters. Chapter 9 should be of particular help to those undertaking crystallization process design projects. Thus, Chapter 1 provides the definition of the basic characteristics that are common to all particulate crystals, notably their molecular structure, particle size, size distribution and shape. Then follows a more advanced description of mixing models, the unified population balance approach to the analysis and prediction of particle size distributions and its coupling with fluid flow. Having provided the theoretical basis, these

chapters naturally lead on to an introduction to the fundamentals and techniques of crystallization and related precipitation processes per se in Chapter 3. Particle formation processes occurring within crystallizers, viz. Then in Chapter 7, the design and performance of well-mixed batch and continuous crystallizers is considered with the population balance from Chapter 2 underlying their theoretical analysis. I am indebted to John Mullin for his encouragement during the writing of this book. Many other academic and industrial colleagues are also worthy of thanks, together with visitors and research students in the UCL crystallization group over the last two decades. Too numerous to mention individually, they each contributed much for which I am most grateful. I hope that each will see some of their many contributions reflected with due acknowledgement in the text. Thanks are also due to present and former students for their patience in working through the examples and giving feedback on courses. Finally, but most importantly, my special thanks are due to Judith, Robert and Stephen for their continual support during the preparation of the manuscript.

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2: Polymer Testing - [PDF Document]

Chapter 4: Packing, Airports, and Flying, Oh My! First things first: pack early! You'll want to start packing at least a few days before you leave. This way, if you.

The complexities call for a self-contained reference work for students, polymer scientists, industrialists, chemists, and polymer technologists. This book is aimed at answering that call. It presents concepts at the intersections of polymer structure, polymer characterization, and new instrumental methodologies for assessing the char- acteristics of polymers. Various application requirements are covered, with recommendations for the types of instruments best suited for different testing circumstances. It overviews recent work in instrumental methods along with some of the significant advances in polymer characterization. References to key theoretical papers are provided. Possible trends and future developments in quantitative and qualitative analysis are also discussed. This book will encourage scientists and engineers in the polymers field to consider using the new approaches to testing, which can save time and effort in evaluating polymer samples. Students and professionals alike in the polymer processing industries will find this book to be a valuable resource â€"even a supplement to stan- dard texts in polymer science and engineering. About the Author Muralisrinivasan Subramanian is a plastics technology consultant specializing in materi- als, additives, and processing equipment, including troubleshooting. The author obtained his B. Sc in Polymer Tech- nology from Bharathiar University. Muralisrinivasan teaches plastics processing seminars as well as being a Board of Studies Ex- pert member of Colleges in India dealing with curriculum of technology subjects. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any meansâ€"electronic, mechanical, photocopy, recording or any otherâ€"except for brief quotations, not to exceed words, without the prior permission of the publisher. Development of new products is no longer a sequential process leading directly to introduction into the marketplace. Product innovation, development, and in fact the entire process is highly nonlinear and not necessarily sequential. Speeding up and improving the effectiveness of the process must be done in conjunction with a strong regard for safety, health, and environmental values. Characterization of polymeric materials often requires the use of instru- mental methods. This book provides comprehensive, practical, and up-to- date information about modern instrumental techniques. Only the minimum necessary theory is introduced, as the emphasis is on practical applications. Instead, the book provides in-depth treatment of the use of instrumental methods and includes information that can help determine the choice of instrumental technique. The most remarkable developments in instrumental methods took place when really high performance became available commercially. These instru- ments have been in the hands of research scientists for some time now, and they are about to take their place in industry for routine qualitative and quan- titative analysis. This book shows the value of these instrumental methods for a wide range of applications within the polymer industries. Chapter 1 provides an introduction to polymers, their structure, and polymerization techniques. The next four chapters discuss various polymer testing techniques and introduce appropriate instrumental methods: Chapter 6 discusses the important and expanding field of thermoplastics. Chapter 7 concentrates on thermosets, their structure, and some major concernsâ€"especially with the concepts necessary to understand the instrumental approach for classifi- cation and elucidation. Chapter 8 deals with polymer blends and composites, concentrating on the concepts necessary to understand the properties using instrumental methods. This book may be of particular interest to researchers in the polymer industry and to those in academia. It provides a valuable overview of recent work in instrumental methods along with some of the significant advances in polymer characterization, together with references to key theoretical papers. Possible trends and future developments in quantitative and qualitative analy sis are also discussed. The objective of this book is to provide useful information about the test- ing of polymers using new instrumental approaches, and to create a base on which those who are interested may continue their research and studies. Various requirements are covered, with recommendations of instruments for different testing types and methods. New Instrumental Methods discusses both the philoso- phy and the details of selected instrumentation techniques. We hope that it will encourage scientists and

engineers in the polymers field to consider the use of these new approaches to testing, which can be very helpful in evaluat- ing polymer samples with a minimum of time and effort. Dedication This book is dedicated to my late father Subramanian, my mother Thangamani, my wife Himachalaganga, and my sons Venkatasubramanian and Sailesh. It is also dedicated to my professors and, above all, to God, who put me on this earth. Muralisrinivasan Natamai Subramanian xv About the Author Muralisrinivasan Subramanian is a plastics technology consultant special- izing in materials, additives, and processing equipment, including trouble- shooting. He obtained his B. Muralisrinivasan worked in the plastic process industry, mainly in research and development, for 13 years before turning to consultancy and building up an international client base. He teaches plastics pro- cessing seminars as well as being a member of the Board of Studies for Expert Colleges in India, deal- ing with curricula for technology subjects. They become even more complex as a result of blends, composites, and branched and graft structures of unusual architecture. The polymerization must be carefully controlled to obtain the desired properties and processing characteristics. Therefore, it is necessary to understand the influence of polymer properties on their end-use performance. The poly- mer industry has also grown, and consumption is increasing every year. It is necessary to understand the various facets of the polymerization process in order to understand the variations in polymer properties. The first useful attempts to create polymers with modification occurred in the middle of the nineteenth century. The nitration of cellulose [1] was reported in Vulcanization of rubber was patented in by Goodyear [2]. By the end of the nineteenth century, celluloid was in common use. Celluloid could be said to be the first synthetic or at least partly synthetic plastic. From that point on, the scope of application of many polymers, both natural and synthetic, has been widened by suitable chemical modifications. Now such polymeric materials are produced in large quantities for com- mercial applications. Polymers are used in a wide range of applications, such as in the automotive, construction, electronic, cosmetics, and pharmaceutical industries. Polymeric materials can be prepared by various polymerization techniques, including anionic [3], cationic [4,5], or radical [6â€”9] processes. Polymers have also attracted other-than-conventional materials because of certain advantageous material properties. However, significant challenges remain in the field of polymers, due largely to major advances in recent years. Particularly in the polymer industry, 2 Polymer Testing characterization and quality control remain significant barriers to progress. The challenges in characterization and quality control are to develop experi- mental techniques for the rapid and precise measurement of properties. Even in polymer processing, numerous chemical reactions occur, produc- ing considerable changes in physical and chemical properties. Sometimes these reactions may shorten the lifetimes of finished products. During pro- cessing with temperature at defined shear rates and in the presence of oxy- gen, mechanical initiation and thermal oxidation transformations occur. However, at the same time, polymer degradation occurs, and at relevant tem- peratures chemical reactions may take place due to thermal, mechanical, and autocatalytic factors, with involvement of free radicals, ions, ion pairs, and low-molecular-weight species. In characterizing polymers, quality control is especially important, with the objective of ensuring that the product remains suitable for its intended end use over its entire lifetime [10]. Traditional methods were manual measurements that were time- consuming, tedious, operator-intensive, with subjective interpretation. To measure certain well-defined properties such as rheology, the common pro- cedure was to use a simple, one-point empirical test method rather than a more complex procedure. Instrumental methods offer operational simplicity, and industrial researchers were quick to accept these more modern tech- niques. Modern methods have become a preferred analytical tool for general scientific research, and for product specification. Their impact on science and technology has therefore been very significant. Modern instrumental techniques have provided experimental and theo- retical advances in understanding the fundamentals and the properties of polymers in their glassy, rubbery, and molten states. They have helped to classify polymer mechanical properties and have resulted in significant understanding of polymers. Experimental data is also utilized to study theoretical phenomena, which in turn has proved extremely useful to poly- mer researchers. They help us understand polymer struc- tures and their relationship to performance. They also establish the validity of techniques for quantitative detection of structural heterogeneity of both polymeric materials and processed end products. Polymer Basics In a reaction system, monomer or a mixture of monomers is added along with several other ingredients such as a catalyst, an

initiator, and water, depend- ing on the type of polymerization process. With agitation at a specific speed, the time, temperature, and pressure are controlled carefully. The monomer is converted into polymer during this process. However, the properties of the final polymer depend on several factors such as the monomer-to-water ratio, if water is present, the degree and speed of agitation, the removal of exothermic heat during the polymerization process, and the solubility of the monomer. For the same type of polymer, different polymerization techniques are also used. A polymer with the same size is difficult to produce, and we are often forced to live with variations in the size and weight of molecules in a polymer. Variations and the weight of the polymer molecules are extremely difficult to control. Morphological Aspects The polymeric chain as a whole must be considered in terms of its mor- phological aspects. In a polymeric chain, the architectural arrangements are known as topology. There are many different arrangements, such as linear polymers, networks, branched, cyclic, block, and graft copolymers. However, there are considerable differences in properties between linear polymers versus networks, branched and cyclic polymers, as well as block and graft copolymers. The differences arise primarily because of the differ- ent motional constraints imposed and the consequent effects of salvation, entangle ment, etc. Chemical Aspects In polymers, the molecular structure determines chemical aspects. Chemical aspects include types of monomer repeat units and rely ultimately on the 4 Polymer Testing solid-state structures and physical properties. The solubility and bulk prop- erties of concern are mainly the glass transition temperature, melting tem- perature, crystallinity, and modulus. These depend on the chain flexibility, symmetry, and intermolecular attractions, that is, the chemical nature of the polymeric molecules. Classification of Polymers Polymers have different properties with increasing number of chain ends. Polymer classes, determined by their properties, are discussed below, with the exception of network polymers. A network polymer is one enormous molecule with relatively few chain ends. Homopolymers Homopolymers are prepared using a single type of monomer with a linear chain structure. In the solid state, the behavior of the homopolymer is due to interactions among its molecules. The magnitude of the interactions is dependent on the nature of the intermolecular bonding forces, the molecular weight number of chain ends , the manner in which the chains are packed, and the flexibility of the polymer. Copolymers When two or more different repeat unit structures are incorporated into a polymeric material, it is known as a copolymer. The linear molecules change the bulk polymer properties by cross-linking.

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3: Chapter 4: Packing and Selling Everything We Own â€“ Little House on the Water

This feature is not available right now. Please try again later.

By littlehouseonthewater February 1, During dinner for the past few months, our family has been inspired by several other families who had sold everything, bought a mono-hull sailboat and vlogged their adventures. We were determined to find out. Our landlord had already been notified of our intentions to move out at the end of the month. Walking through room by room, I first uncluttered them. I began sorting things into categories: Anything that was not practical or bigger than a shoe box, simply could not come. Our bedroom set was the first thing to walk out the door that very first week. I was glad the first thing to go was something of Ryan and mine. We daily posted our belongings on Offer Up and a community Facebook account. I am so thankful to my sister-in-law, who enjoys social media, helped me post and negotiate prices and pick ups, so I could continue packing up our house and take care of the kids. Slowly, our furniture started walking out our door. Most of our clothes had previously come from an excellent Value Village around the corner. Sorting through all our clothes was easiest done in categories: Feeling pretty and sexy has always been important for our marriage. We may miss our closet full of clothes, but what we really need was only a few interchangeable articles that could be layered. I figured as we live on the boat, we would purchase new specific articles of clothing as needed. That helped give me peace of mind. All fall and winter, we used Blue Apron for our dinners. They are delicious meals!! Looking through their holiday catalogue of what things I could purchase, I set aside these things that I already owned. I then added what I normally use when I bake cookies or things. Anything I kept, had to be practical and if multi-purposed or nested, all the better! All other kitchen gadgets and electronics, had to go. The other thing that was interesting to wrap my head around, was this new issue of power. How many watts, amps and volts did something take to use? If it drew too much power, it could be a fire hazard on board the vessel. February 19th, the crib that held three of our four kids, left our family. It was so hard to believe how fast our kids have grown! Our daughters had been sharing a room for a few years. February 22nd, our most comfortable couch of 12 years left us. Before it did, our kids wanted to build one last fort with its cushions.

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