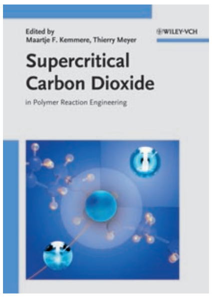
Supercritical Carbon Dioxide in Polymer Reaction Engineering



Edited by *Maartje F. Kemmere* and *Thierry Meyer*. Wiley-VCH, Weinheim 2005. 339 pp., hardcover € 129.00.—ISBN 3-527-31092-4

Browsing through the pages of your favorite newspaper, you might recently have noticed the advertising campaign of DuPont claiming "absolute safety" for its famous teflon cookware. The company is spending a large budget in reaction to the sad news that traces of the surfactant perfluorooctanoic acid (PFOA) used in the manufacture of PTFE and related waterproof fabrics have been found in the blood of people across the United States and the world, including those living thousands of miles from the manufacturing sites. The product is persistent in the environment and causes developmental and other adverse effects in laboratory animals; a June 2005 report from the US Environmental Protection Agency's science advisory board concluded that the EPA should classify the chemical as a "likely" carcinogen in humans. Eventually, the EPA imposed a fine of over $10 million on DuPont, for failing to disclose health and safety data.

Yet, as the authors of the eighth chapter of this interesting book edited by Kemmere and Meyer explain, a number of fluoropolymers, including PTFE, can be advantageously synthesized in supercritical carbon dioxide ($scCO_2$), giving a product with superior properties (compared to that obtained with traditional polymerization in a water/surfactant solvent mixture). At the end of the reaction, the pressure is released and the white polymer is collected, while CO_2 is vented off and recovered for recycling. Clearly, such a production process meets the zero-waste requirement of sustainability (indeed, the book's cover shows a green leaf label with the "green chemistry" symbol above).

The book is well organized in 14 chapters that are authored by leading scientists in the fields of supercritical fluids and polymer science and technology. It begins with a section describing the physicochemical principles (Chapters 1–5), continues with a second part that deals with polymer syntheses (Chapters 6–9), and ends with post-processing (Chapters 10–14).

The best chapters are the most concise ones. I particularly recommend practitioners who are concerned with reactions in $scCO_2$ to read Chapter 7 by Beckman. Incidentally, the reader will also get a valuable overview of the intellectual debate about the nature of solution in compressed carbon dioxide, which has important consequences for planning fruitful research in an area where many of these aspects are often overlooked.

Whatever application of $scCO_2$ is your special area of interest, such as the dyeing of fabrics with dyes dissolved in $scCO_2$ (which penetrates into the polyester fibers), or whether you wish to understand why DuPont has invested $275 million in the construction of a $scCO_2$-based teflon production facility, this book will provide the desired information.

Finally, bringing CO_2 to the supercritical state is not cheap. Despite its relatively low supercritical pressure (73.8 bar), most applications use pressures in the 100–200 bar range to give increased density and solubilization power. I would therefore have welcomed a final chapter about the economics of producing and processing polymers in this versatile solvent. That would certainly provide the arguments needed by researchers who are trying to sell novel technology to an ever more demanding management faced by competition from low-wage countries and increasing energy costs arising from the skyrocketing price of oil. These aspects will probably find space in future editions. This book deserves attention, even by the nonspecialist who is considering $scCO_2$ as a potential solvent for a polymer chemistry research programme.

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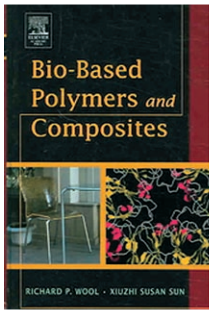
Bio-Based Polymers and Composites



By *Richard P. Wool* and *Xiuzhi Susan Sun*. Elsevier Science, Amsterdam 2005. 620 pp., hardcover $ 99.95.—ISBN 0-12-763952-7

This book was written by the two co-authors named above, but it has some of the flavor of an edited book, since ten of the chapters are labeled as coming from the first author and the remaining six from the other. In any case, the goal of the book is to provide an overview on how materials from plants and animals can be used in applications as polymers or polymer-based composites. The authors certainly succeed, by producing a "Green" book that will be a tremendous resource for polymer scientists and engineers, materials scientists, and agricultural practitioners. It is very much up-to-date, with a lot of useful information on topics that are currently of much general interest, for example, nanocomposites containing exfoliated clays or nanotubes.

The first part of the book emphasizes feedstocks and some relevant processing techniques (extractions, refining, etc.). The use of the resulting materials

