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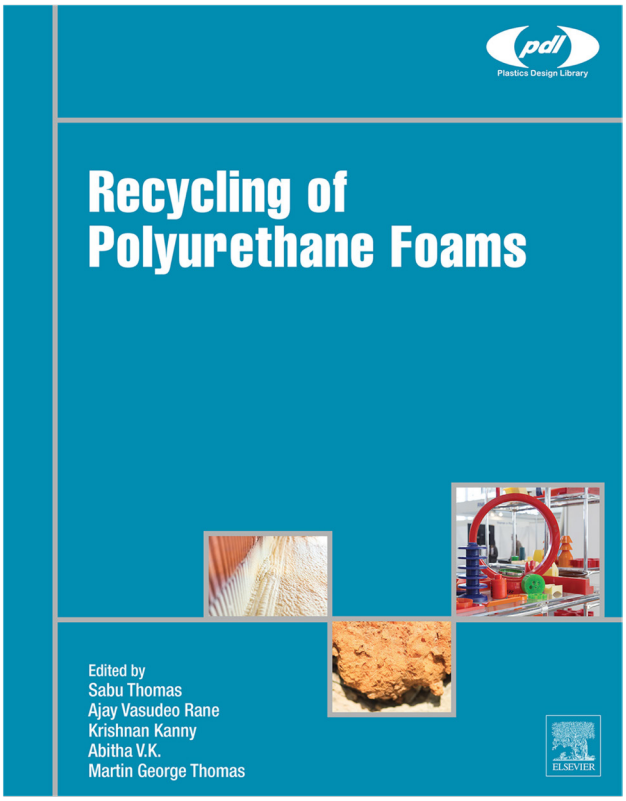
BOOKS REVIEW



RECYCLING OF POLYURETHANE FOAMS

Edited by Sabu Thomas, Ajay Vasudeo Rane, Krishnan Kanny, V.K. Abitha and Martin George Thomas

Since its invention by Otto Bayer and his group in 1937, and following production with the purpose of coating aircrafts during World War II, Polyurethane (PU) foams have been used extensively in furniture, insulation panels, medical appliances, automotive interiors and in a number of consumer products for daily use. The impressive development of polymer and plastic industry results in billions of tons of polyurethane produced annually, which generates the need for the concurrent development of recycling strategies for waste products.

Recycling of Polyurethane foams, recently published by Elsevier within the PDL (Plastics Design Library) book series, encompasses 133 pages of essential information for students, researchers and practitioners interested in the fundamental processes and technologies in the PU recycling industry. The main idea behind the book, which consists of 10 chapters by different authors, is to provide comprehensive information on all aspects of the cycle of PU products, from manufacturing to end use, recycling, thermal treatment and landfill disposal.

The book starts with a broad introduction to polymers, including its classification and its history. The descriptions of different types of plastics and their application follows, with an overview of traditional recycling technologies and the challenges and opportunities for improvement.

The focus then moves onto PU foams, with a thorough description of the chemistry behind the production and of the specific properties at the base of the global success of PU foams. Recycling concepts are introduced and details are given in the following chapters about mechanical and chemical recycling methods. In particular, mechanical treatment is described, from the reduction of PU waste scrap into particles (regrinding) to the addition of binders for rebonding, adhesive pressing and compression or injection molding. Three full chapters are devoted to the comprehensive description of chemical treatment methods which allow depolymerization to occur and monomer production for further use in production processes. The chemistry and reaction schemes behind glycolysis, hydrolysis, ammonolysis and aminolysis of PU foams are thoroughly presented and discussed. Combined methods are introduced and their potential to reduce drawbacks is described, underlining the need for further innovation and the limits of current approaches.

State of the art technologies are reported, along with recently patented processes involving different chemicals and based on new concepts limiting the production of undesired compounds during recycling, as results from the analysis of most recent literature.

A thorough comparative assessment of Life Cycle Analysis studies of PU foam wastes is carried out, providing insights into the improvement of the environmental performance of PU foams thanks to the replacement of traditional blowing agents with new ones, with negligible global warming potential.

The last chapter focuses on advances in construction applications of PU foam wastes, including the use of triturated PU waste for the production of coating materials, modified bitumen and PU-based adhesives, providing not only for a reduction of production costs but also improving properties such as thermal conductivity, durability and long term behavior in comparison with traditional products.

Overall, this book offers a collection of excellent contributions covering all aspects of the life cycle of PU foams, structured in a convincing way with numerous links between the chapters. The result is an essential manual which leads both the experienced reader and the newcomer through an exciting path, unveiling the science and technology of state of the art PU production and recycling processes, shedding

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new light on the limits of current approaches, advances in research and future opportunities for closing the material cycle.

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