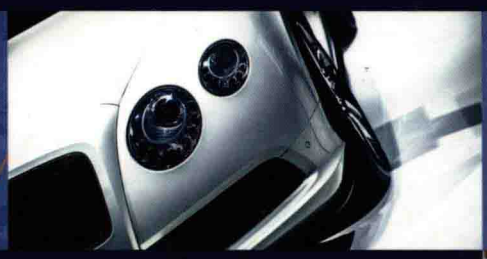
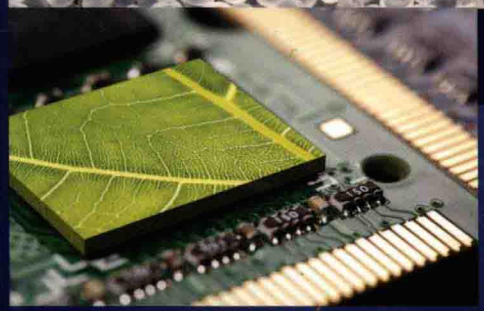
Polymer Science and Plastics Engineering



Lignocellulosic Polymer Composites

Processing, Characterization, and Properties

Edited By
Vijay Kumar Thakur



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To my parents and teachers who helped me become what I am today

Vijay Kumar Thakur

Preface

The development of science and technology is aimed to create a better standard of life for the benefit of human beings all over the world. Among the various materials used in present day life, polymers have substituted many of the conventional materials, especially metals, in various applications due to their advantages. However, for some specific uses, some mechanical properties, e.g. strength and toughness, of polymer materials are found to be inadequate. Various approaches have been developed to improve such properties. In most of these applications, the properties of polymers are modified using fillers and fibers to suit the high strength/ high modulus requirements. Generally, synthetic fibers such as carbon, glass, kevlar etc., are used to prepare the polymer composites for high-end sophisticated applications due to the fact that these materials have high strength and stiffness, low density, and high corrosion resistance. Despite having several good properties, these materials (both the reinforcement and polymer matrices) are now facing problems due to their shortcomings especially related to health and biodegradability. Moreover, these fibers are not easy to degrade and results in environmental pollution. On the economic side, making a product from synthetic fiber reinforced polymer composites is a high cost activity associated with both manufacturing process and the material itself. The products engineered with petroleum-based fibers and polymers suffer severely when their service life meets the end. The non-biodegradable nature of these materials has imposed a serious threat to the environment when ecological balance is concerned. These are some of the issues which have led to the reduced utilization of petroleum-based non-biodegradable composites and the development of bio-based composite materials in which at least one component is from biorenewable resources.

Indeed, the concerns about the environment and the increasing awareness around sustainability issues are driving the push for developing new materials that incorporate renewable sustainable resources. Researchers all around the globe have been prompted to develop more environmentally-friendly and sustainable materials as a result of the rising environmental awareness and changes in the regulatory environment. These environmentally-friendly products include biodegradable and bio-based materials based on annually renewable agricultural and biomass feedstock, which in turn do not contribute to the shortage of petroleum sources. Biocomposites, which represents a group of biobased products, are produced by embedding lignocellulosic natural fibers into polymer matrices and in these composites at least one component (most frequently lignocellulosic natural fibers as the reinforcement) is from green biorenewable resources. For the last two decades, lignocellulosic natural fibers have started to be considered as alternatives to conventional man-made fibers in the academic as well as commercial arena, for a number of areas including transportation, construction, and packaging applications. The use of lignocellulosic fibers and their components as raw material in the production of polymer composites

has been considered as technological progress in the context of sustainable development. The interest in lignocellulosic polymer composites is mainly driven by the low cost of lignocellulosic natural fibers, as well for their other unique advantages, such as the lower environmental pollution due to their bio-degradability, renewability, high specific properties, low density, lower specific gravity, reduced tool wear, better end-of-life characteristics, acceptable specific strength and the control of carbon dioxide emissions.

Keeping in mind the advantages of lignocellulosic polymers, this book primarily focuses on the processing, characterization and properties of lignocellulosic polymer composites. Several critical issues and suggestions for future work are comprehensively discussed in this book with the hope that the book will provide a deep insight into the state-of-the-art of lignocellulosic polymer composites. The principal credit of this goes to the authors of the chapters for summarizing the science and technology in the exciting area of lignocellulosic materials. I would also like to thank Martin Scrivener of Scrivener Publishing along with Dr. Srikanth Pilla (Series Editor) for their invaluable help in the organisation of the editing process.

Finally, I would like to thank my parents and wife Manju for their continuous encouragement and support.

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