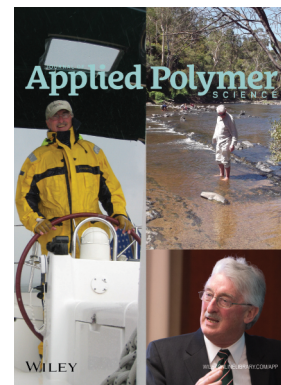


Special Issue: Sustainable Polymers and Polymer Science  
Dedicated to the Life and Work of Richard P. Wool

Guest Editors: Dr Joseph F. Stanzione III (Rowan University, U.S.A.)  
and Dr John J. La Scala (U.S. Army Research Laboratory, U.S.A.)



#### EDITORIAL

Sustainable Polymers and Polymer Science: Dedicated to the Life and Work of Richard P. Wool  
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Richard P. Wool's contributions to sustainable polymers from 2000 to 2015  
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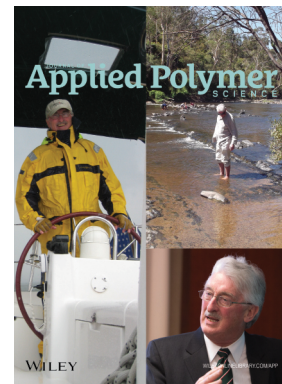
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## Sustainable Polymers and Polymer Science: Dedicated to the Life and Work of Richard P. Wool

Welcome to this special issue of the *Journal of Applied Polymer Science* dedicated to the Life and Work of Richard P. Wool on Sustainable Polymers and Polymer Science.

Renewable resources have been used to produce polymers since the advent of polymer science, and in fact were the primary focus of research until the 1940s. Yet since World War II petroleum-derived polymers have dominated the field. Beginning in the 1990s however, there was general acceptance that petroleum was finite, and development of a renewable economy for energy, chemicals and organic materials is required. Richard Wool recognized that renewable materials – including plant oils, lignin and cellulose – contain monomer units and chemical functionality that could enable them to produce a variety of environmentally sustainable polymers. Furthermore, he demonstrated that high performance structural composites could be produced from renewable chemicals; thus changing the perception of renewables from niche application and low performance to mass production of high performance materials. As a result of Richard's leadership, influence and technical developments, combined with the increased socioeconomic volatility surrounding petroleum in the first decade of the 21<sup>st</sup> century and the solidification of green chemistry and engineering principles, a world-wide effort towards advancing sustainable polymers is now in full force.

This special issue begins with a review of the sustainable polymers research Richard undertook – from triglyceride-based thermosets, structural composites, adhesives and foams, to using chicken feathers to fabricate electronics, modified lignin additives in polymer resins and lignin-derived monomers for high performance polymers. The second review article is on the subject of green chemistry alternatives to petroleum-sourced epoxy resins and epoxy curing agents (including alternatives to epoxy systems that contain bisphenol A (BPA)) that demonstrate potential for reduced toxicity while maintaining high thermal and mechanical properties. Although Richard focused on alternatives to BPA largely for (meth)acrylate polymer chemistries, his leadership helped influence other researchers, guiding them towards these areas. The last review focuses on the development of carbon fibers from lignin (an interest Richard had during his sabbatical at University College Cork in 2002). Polyacrylonitrile-derived carbon fibers currently dominate the carbon fiber market; however lignin-based carbon fibers potentially enable a major industrial shift to the use of sustainably-sourced and environmentally friendly-manufactured carbon fibers for a wide variety of applications.



Prof. Richard P. Wool examining an eco-leather shoe made from natural fibers and plant oils. Credit: University of Delaware/Photo Services

The primary research articles in the issue begin with the principal focus of Richard's sustainable polymers work: thermosetting polymers. The papers span the latest developments in alternatives to styrene in vinyl esters, the use of CO<sub>2</sub> to produce polycarbonate polyols for the development of polyurethane foams, and epoxy resins derived from *p*-cymene, carvacrol and eugenol. Additional works center on the development of renewable thermoplastic polymers, including polyacetals, polyamides, polyesters and polylactic acid. Next, the articles focus on nanocomposites using renewable binders, such as bio-polyurethane, starch and polylactic acid, and/or renewable fibers, including cellulose nanofibers. Advances in the use of renewables in the field of traditional fiber-reinforced composites are also presented in the issue – introducing chicken feather/glass reinforced epoxy composites and a sandwich structure composed of palm-oil composite foam and flax/epoxy laminates. Lastly, developments in lignin-based carbon fibers are reported for unmodified organosolv lignin and acetylated Kraft pine lignin.

As Guest Editors, we would like to thank all of the contributors for joining us in commemorating the life and work of Richard P. Wool by submitting their new research and reviews to the *Journal of Applied Polymer Science*. Additionally, we would like to thank all of Richard's collaborators over the years, and our fellow sustainable polymers and green chemistry and engineering researchers for their profound influence on him, his career and that of his students. We would also like to extend our thanks to the *Journal of Applied Polymer Science* Deputy Editor, Hilary Crichton, and the rest of the editorial team for their

hard work, dedication and consistent professionalism in handling all the manuscripts of this special issue. The issue would not have been possible without their collective input. Importantly, we would like to thank Richard's family, including his wife Deborah and daughters, Sorcha, Meghan and Breeda, for their graciousness and welcoming spirit to all new students in the Wool group. We very much appreciate their fostering of Richard's creativity, as well as their courage in 1995, embracing a new home when Richard joined the faculty of the University of Delaware. The move catalyzed a seismic change in the Wool research group from polymer physics to the chemistry and materials science and engineering of sustainable polymers, helping spark a new era in renewable polymers across the globe. Lastly, we would like to thank you, the reader, for spending the

time to learn a little bit about Richard Wool and for reading about the promising path towards a more sustainable polymers future we, as Wool-inspired scientists and engineers, are representing and highlighting in this special issue. Enjoy!

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