

# Polymers for the Future

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It was in 1920 when Hermann Staudinger proposed that compounds such as cellulose or proteins were long chains composed of short repeating units, in his seminal paper “Über Polymerisation” (“On Polymerization”).<sup>[1]</sup> Since this discovery 100 years ago, polymers have had a tremendous impact on our society. Their broad success in consumer products, in agriculture, in medicine, as packaging materials, as membranes, in construction and building materials and many more areas is due to their large versatility and broad range of properties. Nevertheless, today we also face the challenges of polymers when it comes to their impact on our environment and the goal for a more and more sustainable living.

Thus celebrating the 100<sup>th</sup> anniversary of polymer science is a great opportunity for *Macromolecular Chemistry and Physics* to initiate editorial activities aimed at highlighting the role of polymers in our society and how they may help tackling societal challenges.

In a series of articles collected under the title *Polymers for the Future*, scientists from academia and industry were invited to provide their views on opportunities offered by advanced polymer systems in technology, biomedicine, and for a sustainable economy. The different articles nicely show both, the importance but also the diversity of *Polymers for the Future*.

One crucial topic surely is and will remain the subject of sustainable polymers addressing societal awareness for the environment. The stability of polymers against environmental factors, chemicals, microorganisms, and hydrolysis has challenged society with the accumulation of plastic waste and its management worldwide. In her Trend article, Seema Agarwal addresses the environmental acceptability of biodegradable polymers and the opportunities and challenges they offer to solve the problem of microplastics and their impact on the environment.<sup>[2]</sup>

For a sustainable economy, scientist at academia and industry need to develop green synthetic methods. Haifeng Gao and co-authors show an elegant synthetic approach for the synthesis of hyperbranched polymers using metal-free atom transfer radical polymerization (ATRP) in microemulsions. The method allows for tuning the structure and molecular weight of hyperbranched polymers using confined nanopore.<sup>[3]</sup>

Healthcare is a critical issue for the growing global population. One of the topics that need to be addressed in biomedical



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treatments is the biological targeting at a cellular level. Protein-carbohydrate recognition is essential for a variety of biological processes, including cell growth regulation, adhesion, and cancer. In their paper Gokhan Yilmaz and C. Remzi Becer envision how precision polymeric architectures designed with advanced synthetic methods may help to better understand and utilize the protein-carbohydrate recognition in developing novel treatments.<sup>[4]</sup>

Polymers have much to offer to new high-tech technologies. Lithium-ion batteries are part of modern life, being present in mobile phones, tablets, computers, watches, sport accessories, electric scooters, and cars. The current challenge is to develop a next generation of batteries with improved performance, higher safety, higher sustainability, and low price. David Mecerreyes and coauthors highlight recent developments in innovative polymers and their potential role in the next-generation batteries. They show how innovative polymers are leading to new battery technologies such as metal–polymer batteries, organic batteries, polymer–air, and redox–flow batteries, which are expected to complement the current lithium-ion technologies in the future.<sup>[5]</sup>

The quest for materials with suitable property for a specific application has been the subject of research for many years. Fluoropolymers present outstanding properties that make them ideal materials for applications as protective coatings, fuel cell membranes, elastomers, specific items in automotive industries, aerospace and aeronautics, and microelectronics. Bruno Améduri provides an overview of the large range of properties exhibited by fluoropolymers and their applications. Importantly, he points to key challenges that need to be addressed in a combined effort by academic and industrial researchers.<sup>[6]</sup>

An industry viewpoint on polyurethanes and their future development will be the subject of an upcoming article by Volker Schädler at BASF.

These and many more upcoming contributions are being collected in the virtual special collection *Polymers for the Future* on the *Macromolecular Chemistry and Physics* website at: [https://onlinelibrary.wiley.com/doi/toc/10.1002/\(ISSN\)1521-3935.Polymers.for.the.Future](https://onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1521-3935.Polymers.for.the.Future)

We would like to take this opportunity to also announce an upcoming perspective article on the future of polymer science written jointly by the Editors and Advisory Board of *Macromolecular Chemistry and Physics*.

We invite you to check out for new articles at the above URL.

Finally, we would like to thank all the scientists who have been sharing with us their views on what the future holds for polymer science. It was an honor to work with them all and we hope that the readers will find in the articles new inspirations for their future work and our future perspectives on polymers.

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  - [5] D. Mecerreyes, L. Porcarelli, N. Casado, *Macromol. Chem. Phys.* **2020**, 221, 1900490.
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