

# Past and Present Research Systems of Green Chemistry

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## Green Chemistry in niche applications: Development of “green” photoresists

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The idea that the synthesis and application of chemicals should more significantly be determined by environmental aspects has met international agreement. Nonetheless, “green” alterations so far have often been met by niche products. On the example of photoresists, possible strategies for a more environmental benign synthesis and formulation as well as their application considering health concerns will be presented. Due to their ability to reproduce 2.5- and 3-dimensional patterns, polymer-based photoresists have been applied for wafer production, lab-on-a-chip manufacturing, and surface finishing. So-called negative photoresists are cross-linked upon irradiation with UV light; non-cross-linked areas remain soluble and can be removed from the resist by simple dissolution. After the development of a water-soluble photoresist, eliminating volatile organic solvents from that process step (WO 2013/036979) we have recently complemented our toolbox by a photoresist derived from renewable resources. The 2-oxazoline monomers utilized for the synthesis of the copolymer to be cross-linked were synthesized from the reaction of undecenoic acid (castor oil) and decanoic acid (coconut oil), respectively, with ethanol amine. The copolymerization itself was performed at 300 g-scale in a remarkably energy-efficient process, namely under microwave irradiation in ionic liquids, which are prime absorbers of microwave irradiation. Upon cooling after the polymerization, the copolymer precipitated, enabling for the recovery of the product and the ionic liquid. Notably, the ionic liquid could be used as reaction medium in subsequent polymerizations. Cross-linking reactions of the copolymer were realized by thiol-ene reactions of the copolymer and a tetrathiol. Resolutions of 1  $\mu\text{m}$  were achieved.

### Biography

Frank Wiesbrock completed his PhD thesis from the Munich University of Technology. After Postdoctoral stays at the Eindhoven University of Technology and the National Hellenic Research Foundation, he completed his habilitation in Macromolecular Chemistry at the Graz University of Technology in 2012. He has joined the Polymer Competence Center Leoben in 2012. He is the manager of the Poly Comp - Functional Polymer Composites - project. He has published more than 60 papers and is Editor-in-Chief of the *American Journal of Macromolecular Science* and the Editorial Board Member of *Polymers and Current Microwave Chemistry*.

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