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Athina Anastasaki is the Head of the Laboratory of Sustainable Polymers at ETH Zurich and an Associate Professor in the Materials Department. She completed her PhD studies under the supervision of Professor Dave Haddleton at the University of Warwick, where she was honored with the Jon Weaver Award for the best polymer chemistry doctoral thesis in the UK. She then held a Global Marie Curie Fellowship and an Elings Fellowship during her post-doctoral research with Professor Craig Hawker at the University of California, Santa Barbara. In 2019, Athina launched her independent career at ETH Zurich as an Assistant Professor, before her promotion to Associate Professor in 2025. Her group focuses on developing modern chemical recycling methodologies and sustainable polymer synthesis. Beyond her research, she serves as an Associate Editor for the RSC journal *Polymer Chemistry*. Her lab's work has been recognized with the 2025 ACS Sustainable Chemistry & Engineering Lectureship Award, the 2025 ACS Global Outstanding Mentor Award, the 2024 Kavli Foundation Emerging Leader in Chemistry Award, the 2024 Journal of Polymer Science Innovation Award, and the 2023 ACS Macro Letters/Biomacromolecules/Macromolecules Young Investigator Award.

Abstract: “Reversing Radical Polymerization: From Polymers to Monomers”

The accumulation of plastic waste presents a significant environmental challenge, necessitating a transition from a linear to a circular polymer economy. Unlike traditional recycling methods that can result in downcycling, chemical depolymerization offers a pathway to recover high-purity monomers for virgin-grade materials. For certain vinyl polymers, depolymerization is thermodynamically favorable at temperatures below 200°C; however, the primary kinetic barrier lies in reactivating an inert chain into a reactive, unzipping macroradical. Our group has demonstrated that polymers synthesized via reversible deactivation radical polymerization (RDRP) can be effectively exploited for low-temperature depolymerization, leveraging well-defined chain-end functionalities as chemically accessible initiation points. While this "recyclability-by-design" approach enables controlled depropagation, commercial materials like Plexiglass (PMMA) lack these specialized end groups. To address this limitation, we developed a mid-chain activation approach. By strategically abstracting hydrogen atoms from the polymer backbone, we generate unstable mid-chain radicals that undergo beta-scission and subsequent unzipping. This method facilitates the low-temperature chemical recycling of commercial-grade PMMA, successfully bridging the gap between sophisticated synthetic polymers and bulk waste streams.