



## Chemistry Colloquium

# Making and Unmaking Vinyl Polymers via Radical Polymerizations

**Athina Anastasaki**

ETH Zürich, Department of Materials,

Host: Rafal Klajn

Controlled radical polymerization (CRP) is widely used to prepare a broad range of polymeric materials for diverse applications in various fields [1,2]. One of the most important properties of CRP polymers is the ability to maintain high livingness throughout the polymerization. In the first part of the talk, an acid-triggered radical polymerization will be demonstrated which leads to the next generation of complex multiblock copolymers with controlled sequence, dispersity, and end-group fidelity [3,4]. Although high end-group fidelity is crucial to facilitate the synthesis of well-defined block copolymers, it has rarely been exploited to reverse controlled radical polymerization and regenerate the starting materials. In the second part of the talk, I will first show how, under thermodynamically favoured conditions [5,6], it is possible to depolymerize linear, bulky, cross-linked, and functional polymethacrylates made by reversible addition fragmentation chain-transfer (RAFT) polymerization [7]. Notably, the depolymerization product can be utilized to either reconstruct the linear polymer or create an entirely new insoluble gel that can also be subjected to depolymerization. A solvent-free chemical recycling methodology that efficiently operates for both ATRP and RAFT-synthesized materials will also be presented [8]. However, both depolymerization reactions are uncontrolled in nature (i.e., rapid monomerization of activated chains), thus providing no handle over the molecular weight and limiting further applications. To address this, a controlled depolymerization strategy is developed that enables a linear decrease in molecular weight over time [9]. Such gradual unzipping of polymer chains is not only useful for recycling purposes but also enables the structural characterization of various copolymers (i.e., AB diblock vs. BA diblock vs. statistical vs. gradient) by facilitating the sequential release of monomers from the chain-end. At the end, I will discuss how we can potentially utilize the obtained knowledge to switch from designer polymers to commercially available materials containing undisclosed impurities.

Athina Anastasaki  
Department of Materials, ETH Zürich  
polymeric.mat.ethz.ch

Making and Unmaking Vinyl Polymers via Radical Polymerizations  
June 27 Thursday 2024 15:30  
Moonstone Room F[1] K. Parkatzidis, H. S. Wang, N. P. Truong, A. Anastasaki, Chem 2020, 6, 15751588.[2] N. P. Truong, G. R. Jones, K. G. E. Bradford, D. Konkolewicz, A. Anastasaki, Nat. Rev. Chem. 2021, 5, 859869.[3] M.-N. Antonopoulou, R. Whitfield, N. P. Truong, D. Wyers, S. Harrison, T. Junkers, A. Anastasaki, Nat. Chem. 2022, 14, 304312.[4] M.-N. Antonopoulou, G. R. Jones, A. A. Kroeger, Z. Pei, M. L. Coote, N. P. Truong, A. Anastasaki, Nat. Synth. 2024, 3, 347356.[5] G. R. Jones, H. S. Wang, K. Parkatzidis, R. Whitfield, N. P. Truong, A. Anastasaki, J. Am. Chem.

Soc. 2023, 145, 98989915.[6] V. Lohmann, G. R. Jones, N. P. Truong, A. Anastasaki Chem. Sci. 2024, 15, 832853.[7] H. S. Wang, N. P. Truong, Z. Pei, M. L. Coote, A. Anastasaki, J. Am. Chem. Soc. 2022, 144, 46784684.[8] R. Whitfield, G. R. Jones, N. P. Truong, L. E. Manring, A. Anastasaki, Angew. Chem. Int. Ed. 2023, 62, e202309116.[9] H. S. Wang, K. Parkatzidis, T. Junkers, N. P. Truong, A. Anastasaki, Chem 2024, 10, 388401.

## **Thursday, June 27, 2024 11:30am - 12:30pm**

Moonstone Bldg / Ground floor / Seminar Room F (I24.EG.030f)

---



This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.

Please find a schedule of the ISTA Shuttle on our webpage:

<https://ista.ac.at/en/campus/how-to-get-here/> The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.