Séminaire

INSTITUT Charles SADRON
CNRS - UNISTRA - STRASBOURG

Vendredi 15 mars 2024 à 10h30

Amphithéâtre Henri Benoît

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From Stimuli-Reponsive Systems to Renewable Polymer Materials

Responsive materials, capable of adapting their properties in response to external stimuli (i.e. temperature, light, or mechanical force) in a predictable manner, hold great promise in enhancing sustainability and prolonging material life cycles. In this context, our research introduces innovative approaches leveraging stimuli-responsive systems to advance the sustainability of polymer materials. The first approach integrates photoswitchable chemical motifs that can form and break bonds upon exposure to distinct wavelengths of irradiation. A meticulous examination of photomediated formation and cleavage reactions enabled a near-perfect optimization of reaction yields, approaching 100%. Furthermore, the successive execution of both reactions demonstrated a remarkable level of cyclability on both molecular and macromolecular levels, underscoring the potential for future renewable polymerization and ligation mechanisms. The second approach centers on mechanically-activable encapsulated chemistries to produce versatile functional composite materials. Self-reporting materials function has been achieved by encapsulating chromophores, which, upon release, undergo physical changes and result in a visible color change in the damaged region of the material. In an alternate system, these encapsulated entities were employed to trigger the degradation of adhesives upon mechanical compression. The functionality of these composite adhesives has ultimately been harnessed to induce controlled debonding on demand. In summary, our work aims to demonstrate how stimuli-responsive systems can serve as a tool to enhance the sustainability of materials, whether by extending their lifespan or enabling their reutilization.

Les personnes souhaitant rencontrer C. Calvino sont priées de prendre contact avec Daniel Grande.

Biography

Céline received her MS degree from the department of Chemistry at the University of Fribourg, Switzerland, with a focus in organic synthesis, polymer chemistry, and materials science. She completed her master's thesis at Asulab, a division of The Swatch Group R&D Ltd, investigating the formation of homogeneous and resistant anchor layers on the surface of watch components, and on the introduction of the epilam (anti-spreading agent) effect using controlled polymerization processes via "grafting from" and "grafting to" methods. Céline stayed in Fribourg to pursue her PhD in polymer chemistry and materials at Adolphe Merkle Institute. Her thesis focused on the design of chromogenic systems relying on supramolecular interactions and on their incorporation into polymeric materials to create new functional mechanoresponsive materials. Céline embarked on her postdoctoral journey at the Pritzker School of Molecular Engineering, University of Chicago, supported by a SNFS Mobility Fellowship. Her research focused on the use of dynamic covalent chemistry to functionalize cellulose nanocrystals and on the development of appropriate engineering melt processes for the preparation of mechanically reinforced and sustainable nanocomposite materials. In 2021, Céline was appointed as Junior group Leader and principal investigator at the University of Freiburg, Germany, with a research interest on the design of stimuli-responsive systems to achieve renewable polymer materials.