

Projet Life-Cycle : Life-like Supramolecular Materials based on Reaction Cycles with Designed Feedback

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The “Life-Cycle” ERC proposal aims to develop a new class of artificial supramolecular materials that are kept in sustained non-equilibrium states by continuous dissipation of chemical fuels. Supramolecular polymers in current artificial materials stick together through weak reversible bonds that can be exchange by thermal energy. In contrast, natural supramolecular polymers such as those in the cytoskeletal network use chemical fuels such as adenosine triphosphate (ATP) to achieve an incredible adaptivity, motility, growth, and response to external inputs. Development of chemically fueled artificial supramolecular polymers should therefore lead to more life-like materials that could perform functions so far reserved only for living beings.

The proposed materials are based on supramolecular reaction cycles that have both positive and negative feedback in order to achieve emergent properties, such as oscillations and waves. Since the building blocks react, but also self-assemble they have built-in chemomechanical properties, much like in living materials such as the cytoskeleton.