

Reversible Heterolytic Mechanophores for Dynamic Bulk Materials

 *Timeline* | 08/2023 to 07/2028

 *ICIQ People* | [Berrocal Research Group](#)

 *Budget* | 1.498.401 €

 <https://cordis.europa.eu/project/id/101041759>

 *Call* | ERC-2021-STG

SUMMARY

Stimuli-responsive polymers adapt their properties in response to external cues. Engineering such “smart” behavior in artificial systems by molecular design is an exciting fundamental challenge that can lead to technological breakthroughs. Most stimuli-responsive polymers rely on heat and light to trigger changes in materials properties in a predictable fashion. However, limitations intrinsic to these stimuli highlight the necessity of alternative strategies. Naturally evolved systems widely exploit mechanical stimulation to regulate their functions, but recreating such concept in artificial materials has proven extremely challenging thus far.

ReHuse proposes a radically new approach that focuses on the application of mechanical force to induce changes in bulk materials properties isothermally and reversibly. The research project aims at pushing the frontiers of covalent mechanochemistry through the development of reversible heterolytic mechanophores – molecular platforms that dynamically generate and recombine two oppositely charged (macro)molecular fragments upon mechanical stimulation. These new motifs will enable dynamic chemistries involving organic ionic species in solid-state systems in two different types of advanced bulk materials. Combining reversible mechanochemistry and dynamic covalent chemistry will lead to dynamic covalent polymers displaying selective mechanoresponsiveness. This concept will be leveraged to create recyclable materials. The reversible generation of charges from the heterolytic scission will enable to modulate hydrophilicity/hydrophobicity dynamically. Such principles will be explored to set the groundwork for mechano-responsive atmospheric water harvesters. This interdisciplinary research project will advance our understanding of mechanochemistry and, more importantly, will usher new avenues for its productive and repeatable use in adaptive materials.

