

Reversibly Designed Cross-linked Polymers



REDONDO

The project at a glance

INTRODUCTION

- Cross-linked polyethylene (PEX) exhibits higher thermal stability, better chemical resistance and improved structural integrity compared to polyethylene (PE).
- BUT, PEX cannot be melted and recycled/reused

AIM

Synthesis of reversibly cross-linked polyethylene: inherently recyclable & sustainable-by-design



01 Synthesis

- A. Carbon-dithio reversible bonding**
 - Cross-linked network based on S-C-S and S-S bonds.
 - Stable up to 130 °C and cleavable over 200 °C.
- B. Diels-Alder chemistry**
 - Furan/maleimide complementary functions.
 - Cross-linking through Diels-Alder reaction.

02 Green Additives

- Biobased additives**
 - Nanolignin (NL)
 - Nanocellulose (NC)
 - Chemically modified NL & NC
- Properties**
 - Flame retardancy
 - Antioxidant
 - Mechanical strength

03 Sustainable & Safe-by-Design

- Life cycle assessments to identify key hotspots for environmental improvement
- Toxicological effects & potential for exposure to health and environmental impact from product inception to end of life
- Development of the **PLACE-me** tool: circular monitoring tool integrating principles of sustainability-by-design along with a holistic value chain assessment

04 Applications

- Processability of newly synthesized rPEX will be evaluated for extrusion.
- Masterbatches will be further formulated
- Two end-users applications:
 - **Pipes** for heating/cooling applications
 - **Cables** for photovoltaic systems

05 Recyclability

- Thermal reversibility of the cross-linking will be assessed.
- Properties of recycled rPEX will be evaluated.
- Recyclability of the final products will be validated.

Communication and Exploitation Activities

- Support the widest diffusion of the project's results to targeted audiences
- Maximise the innovation impacts, contributing to the market uptake of the final products

Meet the Team



Funded by
the European Union

This project has received funding from the European Union's Horizon Europe Framework Programme under Grant Agreement No 101058449. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or HADEA. Neither the European Union nor the granting authority can be held responsible for them.



**Aristotle University
of Thessaloniki**

541 24 Thessaloniki, Greece
+30 2310-997812
redondo@chem.auth.gr



redondo-project.eu