



HAL
open science

Solvo-/hydrothermal processes for materials recycling : towards a circular economy

Cyril Aymonier, Gilles Philippot, Thomas Voisin, Guido Sonnemann

► To cite this version:

Cyril Aymonier, Gilles Philippot, Thomas Voisin, Guido Sonnemann. Solvo-/hydrothermal processes for materials recycling : towards a circular economy. 8th International Solvothermal Hydrothermal Association Conference - ISHA 2023, ISHA, Sep 2023, Valladolid, Spain. hal-04722197

HAL Id: hal-04722197

<https://hal.science/hal-04722197v1>

Submitted on 4 Oct 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

TUESDAY – SEPTEMBER 12th, 2023

Room Dr. Luis de Mercado – Sustainability

11:30 - 12:00 **KEYNOTE LECTURE** 82062.**SOLVO-/HYDROTHERMAL PROCESSES
FOR MATERIALS RECYCLING: TOWARDS A CIRCULAR ECONOMY****Aymonier, C.¹, Philippot, G.¹, Voisin, T.², Sonnemann, G.³**¹Univ. Bordeaux, CNRS, Bordeaux INP, ICMCB, UMR 5026, F-33600 Pessac, France²IDELAM Company, F-33600, France³Univ. Bordeaux, CNRS, Bordeaux INP, ISM, UMR 5255, F-33400 Talence, FranceCorresponding author email: cyril.aymonier@icmcb.cnrs.fr

Solvo-/hydrothermal processes have played a central role in the development of green chemistry in the last decades. In the continuity, they can now offer the opportunity to bring Materials Science into the Circular Economy. Most of the resources/raw materials are not in Europe. The solution is in urban mines if we can discover and develop recycling technologies to transform an end of life material into a raw material of recycling. The main objective of this presentation will be to highlight this novel axis of development of solvo-/hydrothermal processes in the field of materials recycling with the following cases: recycling fibers (carbon, glass and natural fibers) from fiber reinforced polymers (FRP), recycling critical metals from the new technologies of energy (rare-earth-based magnets, Li-ion batteries,...), recycling food packagings and shoes. One version of the solvo-/hydrothermal process can bring a solution to the regeneration of FFP2 facemasks.

The first part of the presentation will concern an introduction to circular economy and the associated challenges. Will follow an overview of the solvo-/hydrothermal processes which are developed for materials recycling, namely solvo-/hydrolysis reactions-based technologies (mainly with water and alcohols as solvents) and delamination-based technologies for complex materials (mainly carbon dioxide as solvent with a possible addition of co-solvents). Beyond the scientific and technical aspects, the environmental impact of these technologies will be addressed using Life Cycle Assessment (LCA). For instance, a comparative analysis will be proposed to position the solvo-/hydrolysis technology among others for the recycling of carbon fibers from composite materials but also for the recycling of bonded magnets.

The last part of this presentation will be dedicated to technology transfer of this family of processes with the example of IDELAM. Since its foundation in 2019, IDELAM has been developing the scCO₂-based technology for an extensive number of applications. Since the first year dedicated to the proof of concept on a large number of products, the start-up has gained a growing interest from industrial manufacturers, recycling centres or eco-organisms and has been labelled by the Solar Impulse Foundation. IDELAM is now transitioning from its capital risk founding toward its capital risk development, and intends to strengthen its collaboration with ICMCB with the development of new projects regarding the use of solvo-/hydrothermal-based technologies for recycling.

Keywords: Circular economy, Recycling, Materials, Solvo-/Hydrothermal, LCA