PROJECT FACTSHEET

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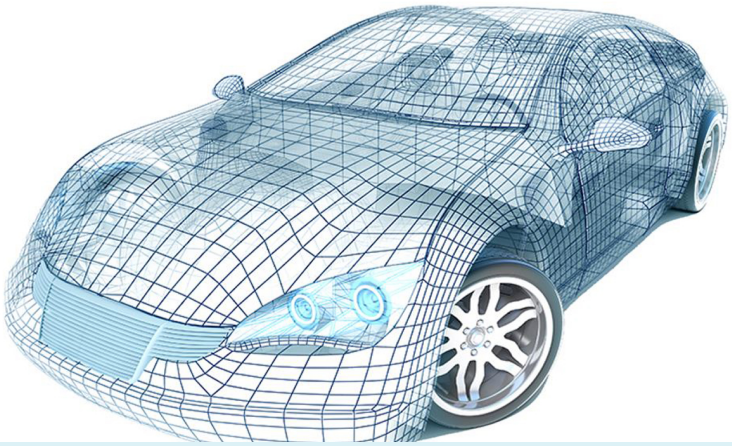
SAFFIA

SAFFIA will develop enhanced thermal insulating parts with environmental and health benefit processes



Inspiration

The European transport market calls for multi-functional parts having lightweight benefits based on sustainable raw materials. Insulating foams and felts have reached a limit in their thermal insulating performances developments. In addition, these parts are mainly based on polyurethanes which originate from crude oil and imply toxic isocyanates use.
To solve these issues, SAFFIA will develop enhanced thermal insulating parts with environmental and health benefit processes. The proposed holistic approach will develop an in situ polymerized nanocomposites composed of biobased non-isocyanate polyurethanes and insulating low density silica-aerogel nanoparticles. Polymerizations and compatibilizations will be conducted in an extruder allowing operating conditions versatility and control over nanoparticle dispersion. The two industrial partners include an automotive producer which will ensure efficient developments from products specifications to TRL6 demonstrators.
The transport industry requires multi-functional part solutions in order to reduce weight as much as possible. Beside this, material design faces a situation of growing concern for sustainability. This is particularly true when considering thermal and acoustic insulating interior parts such as foams and felts that are short fibres reinforced thermoplastic composites non-woven mats.
- Polyurethane polymers (PU) are undoubtably the current material of choice due to a series of factors. First, PUs are very versatile in terms of monomer chemical structure covering a potentially unlimited variety of molecular-level design. Secondly, PUs exhibit inherently low thermal conductivities. However, this class of materials have reached their limit in terms of performances and their synthesis involves the use of isocyanates, which are harmful for human health and the environment. In addition, commercial PUs applied in the automotive industry are based on petroleum therefore there are calls for greener alternatives.
- Aerogels as synthetic highly porous nanoparticles (NP) have received recent increasing attention. Silica aerogels (SA) are a specific class made from cross-linked oxides with pore sizes ranging from 5 to 70 nm. Thanks to their high porosity and specific area, aerogels show the lowest thermal conductivities ever recorded (below 0.02 W/mK) and low material densities. However, when combined with polymers, the corresponding nanocomposites (NC) have a tendency to be brittle and suffer property losses upon ageing due to poor SA / polymer interfacial adhesion.
- Non-isocyanate polyurethanes (NIPU) are an emerging class of polymers with properties comparable to those of PUs, while offering quite a wide range of diverse chemistries too. NIPU main advantage is that they are obtained through a safe process, where isocyanate are most often replaced by cyclic carbonates and diamines. Yet, NIPU also provide better ageing properties such as hydrolytic and chemical resistance and are good candidates in which to incorporate biobased monomers, therefore improving material sustainability.
- Reactive extrusion (REx) is a substitute for traditional batch reactions and are mainly based on the use of co-rotating twin screw extruders. Its design is ideally adapted to continuous chemical reactions in viscous mediums in the absence of solvents. It allows intensifying processes with very positive economic and environmental benefits combining higher polymerization levels and great levels of subsequent compounding within reduced residence times. REx is generally more efficient in terms of consumption of raw materials, reagents, energy and requires less investment.

Innovation

In the SAFFIA project, LIST, FLOKSER and TOFAS are proposing an holistic approach that integrates monomerNP chemical modification, continuous in-situ polymerization and NC compounding by REx. This way, automotive interior insulation parts will be brought to another level of performance in terms of functionality and sustainability:
- Thermal / acoustic insulation, as well as process health hazards will be significantly improved.
- Interfaces between biobased NIPU and SA will be compatibilized. Improvement in long-term performance and ageing resistance are expected.
- Other transversal but crucial specifications will also be targeted such as mechanical strength, low density and fire resistance.

Impact

SAFFIA project will develop two innovative insulation parts for the automotive industry: a felt and foam up to TRL6 demonstrators. LIST and FLOKER will optimise the synthesis and processing while TOFAS will adapt the moulding step and develop demonstrators while ensuring results in industrial transferability. From a TRL2, the RD activities will enable to reach a global TRL of 6.

Partners

TOFAS , FLOKSER

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