AUTOMOTIVE

Polymer-based composites

10_AUTO_PBC_FRA-TP

Title: Fire resistance additives for continuous fiber thermoplastics

Description: Develop additives to give fire resistant properties to continuous fiber thermoplastics. There is a market to develop composite battery housings (top cover or base plate) of BEV (battery electric vehicles). The housings must have fire resistant properties for thermal runaway of batteries and/or protection of batteries from external fire. Describe clearly your challenge. Current solutions are in metal (steel or aluminum) or in some case in thermoset composites. Fire resistant TP composites could reduce the CO_2 footprint of the car and be easier to recycle than thermosets. Composite solutions could be lighter than metals.

Additives should be proposed to be mixed with thermoplastics (PP or PA6). It should not limit the impregnation of the reinforcing fibers (glass in priority) with a high fiber content of 60-70 wt%.

Scope:

- No available "ready to use" additives that have the potential to improve the fire resistance of continuous fiber thermoplastics (PP or PA6) without limiting the fiber content and without reducing drastically the mechanical properties of the composite (strength, modulus, resistance to impact, thermal and ageing behavior)
- Initial objective is to have a UL94V0 classification of the composite with a glass content of 60 wt% of continuous fibers for PP and/or for PA6
- Cost of the additive should be "acceptable" for the automotive industry

Objective:

- L94V0 classification of the TP composite
- Reduction of mechanical performance is less than 10% vs. composite without fire additive
- Cost premium is limited to max 10% vs composite without additive

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12_AUTO_PBC_AdhesiveFilm

Title: Adhesive film to allow structural bonding of composite with metal part during ecoat process

Description: The standard process to manufacture a car is to weld steel part together to make a body in white that is protected for corrosion and painted. The integration of composite parts in a steel body in white is difficult and is today mainly done with adhesive bonding. In that case a liquid adhesive is dispensed on the composite which is then pressed on the metal structure. The adhesive cures in the oven that is used after the ecoat process. This process limits the geometry of the parts that can be assembled and the process is difficult to control.

The challenge proposed here is to develop an adhesive that could be solid when the composite is placed in contact with the metal body. Ideally the adhesive would be placed in the mold when the composite part is molded. The adhesive would then cure when the BIW is placed in an oven around 200°C for a duration of around 15 minutes to create a structural bond between the metal and the composite. Solutions for thermoset and/or thermoplastic composites are of interest.

Hybrid metal/composites structures have a high potential for weight savings

Scope:

- Create a structural bond between a steel part and a composite part (thermoset or thermoplastic) without liquid adhesive and use oven of ecoat process to cure the adhesive the bond between steel and composite. The adhesive should be dry and as a solid thin layer at the surface of the composite to make the assembly process easier for the automotive OEM
- Structural bonding with values of bond around 25 Mpa in simple shear test at new and reduction of less than 25% after wet ageing
- Cost of the additive should be “acceptable” for the automotive industry

Objective:

- Adhesive is delivered as a roll of material (solid)
- Adhesive cures at 200°C in 10 minutes
- Bond between composite and steel is structural (shear strength of 25 Mpa).
- Good resistance of the adhesive after thermal (range -30°C to 80°C) and/or wet ageing
- Cost of the adhesive is compatible with automotive targets

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13_AUTO_PBC_RESeat

Title: Novel child seat components made of recycled thermoplastic fiber reinforced plastic

Description: Development of child seat components with high crash performance for automotive application. New technology combines particle foaming, injection moulding and local continuous fibre reinforcement. This particle-foam composite injection molding (PCIM) process overs a weight and CO_2 saving of up to 30 percent. Re-use of recycled thermoplastic tapes for injection molding of FRP molded component improves CO_2 footprint of the manufacturing process.

This is a challenge in terms of material and technology. It is declared to use recyclates (re-use of thermoplastics tapes) for the child seat production. The product fulfills the criteria of a hybrid composite and combining production technologies and joining various materials, which is important for lightweight composites. Main objective – the development of thermoforming and injection molding in combination with particle forming is new, this is the challenge.

Scope:

- Weight and CO_2 saving of up to 30 percent
- Excellent crash performance for automotive application
- Energy-efficient production process (one instead of two manufacturing processes = CO_2 saving) by Particle-foam composite injection molding
- (Re-)Use of recycled thermoplastic tapes for injection molding of FRP molded component
- Partner for product design is a child seat manufacturer based in Poland

Objective:

- Main objective: the development of thermoforming and injection molding in combination with particle forming
- Development of a functional demonstrator based on a head rest of a child seat (The challenge focuses us on the head rest of the child seat. This is the main component of the child seat with high requirements to crash safety and it's a perfect technology demonstrator. For that reason, the predicted budget is suitable.)
- Development of re-use technology of thermoplastic tapes
- Material analysis and selection
- Topology optimization and numerical design of the structure
- Development of a thermoforming and injection molding tool as well as a particle foaming tool
- Implementation and optimization of the manufacturing process
- Crash tests of the technology demonstrator

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37_AUTO_PBC_Material2design

Title: Material selection tool prior to design phase

Description: Current process solutions enable the production of multi-material composite parts at high lot sizes allowing to replace heavier metal parts in automotive applications. However, this is only possible if the part design is near to optimal. This optimal state is defined by having the minimum amount of the “right” material (for example continuous fiber composite material patches or metal inserts) at the “right” place which allows to comply the specifications while achieving the overall best part weight or cost. One main issue in current design approaches is that a first design must be selected before starting a part optimization. In the latter it is possible to define the lay-up of the composite patches or the exact shape of a metal insert. This first design creation is generally guided by the experience of the engineers and eventually leads only to non-optimal solution.

The goal of the challenge is to create a tool which, starting by a given design space and loadcases, identifies a zoning of the design space which roughly describes which material is to be put in which zone of the design space to achieve the optimal weight or cost. The tool should follow objective rules and have a short runtime. Based on the tools output a first design can be created which can thereafter be optimized in a second step.

Scope:

- To authors knowledge there is no tool on the market supporting the material selection for zones of a multi-material part using objective criteria.
- A link with existing simulation tools (or other supports) can be possible.
- The tool should be able to consider different loadcases on the same part.
- The evaluation time should be reasonable (max 1-2 days or less depending on the part complexity) as used prior to design start.

Objective:

- A tool supporting to select the best material for different zones in a design space prior to defining a proper part design.
- Main criteria: robustness and evaluation time.
- Optimization criteria: Part weight or cost.
- Definition of use cases can be provided as the testing**.**

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38_AUTO_PBC_SUSMA

Title: Sustainable Material Usage in Automotive Industry by Developing New Easy-to-recycle Coating Technology

Description: Recycle and bio plastics are currently using in automotive industry however there are still big hurdles to expand the usage of this materials such as unpleasing odor and insufficient aesthetic properties (especially in the condition of applying foaming technologies). Interior hard trim PP parts have big potential for application of sustainable materials. Easy to recycle, de-bondable coating systems can be developed by using similar thermoplastics so that aforementioned problems can be eliminated. By achieving this, CO_2 emissions will be reduced owing to not using fossil derived sources and lightweighting technologies will be applied such as physical or chemical foaming.

Scope: Usage of recycled or bio plastics has vital importance for automotive industry.

- Enabling the such sustainable materials considering lightweighting and fully replacing with fossil derived plastics.
- To achieve this, developing new coating (including IMD and IML technologies) or additive technology (preventing odor and surface defects) or combining thereof.

Objectives:

- Elimination of surface defects in the condition of fluctuating material properties.
- Lightweighting the parts by using physical & chemical foaming without sacrifising mechanical & thermal properties.
- Developing new coating technology which is applicable for variety of thermoplastics so that preventing unwanted odor and covering surface irregularities could be possible.

Considering design for sustainability, it is expected that whole part needs to be fully recyclable as scrap on EoL. Therefore, new coating or additive need to be compatible with PP so that after end of life it can be recycled and used again without significantly reducing its properties.

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39_AUTO_PBC_FEPREV

Title: Feasible Low-Medium Volume Part Production in Automotive Industry: Focus on customized EVs

Description: Rapid growth in the EV industry leads us to find more agile solutions & processes for manufacturing diversified plastic parts with lower volume compared to injection molding expected part volume. Injection molding is an excellent manufacturing method for high volume production, however it is not feasible for under thousands of parts. Therefore, this technology needs to be substituted by other growing Technologies such as additive manufacturing, in-situ polymerization techniques, or other, when it comes to lower production needs. For instance, reaction injection molding can be applicable and feasible for this situation since mold & equipment investment and the energy consumption is lower. On the other hand, suitable raw materials prices are challenging compared to thermoplastics in the market.

Scope:

- New technology & process adaptation to automotive parts considering feasibility & light-weighting & sustainability in order to make low & medium volume production possible especially for under the hood EV components which only needs up to 10000 annual productions.
- Customizable manufacturing to merge different production lines into one.
- Cost-efficient raw material development for selected manufacturing Technologies.

Objectives:

- Creating manufacturing Technologies that usage of thermoplastics can be possible to produce low-mid volume parts cost-effectively. These Technologies demand customized production aiming at the manufacturing of different variations of the same functional parts with identical equipment.
- Expanding the usage of in-situ polymerization techniques in automotive applications focusing on customized EVs such as AM, RIM, RTM, vacuum infusion by applying thermoplastics to these techniques.

Developing new materials to be cost-effective and to replace thermosets with thermoplastics to rely on circularity. More specifically expanding usage of thermoplastics (PA, PMMA, PBT etc.) in in-situ processes combining them with carbon and glass fibers according to part specifications.

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