Affordable and Sustainable Multi-Material Lightweight Design and Manufacturing

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The use of sustainable and lightweight structures has become mandatory given the ever-rising demand for resource efficiency and sustainability. Structural weight reduction without reducing safety and resistance and increasing costs requires a system-engineering design optimization that combines material properties/functionality and manufacturing processes to meet product and sustainability requirements at the lowest mass and/or cost. With this regard, Thermoplastic Metal Fibre Laminate (TP-FML) composite systems hold a great potential. This class of structures could be tailored through the use of specific sub-components to achieve desired mechanical performances. However, conventional manufacturing of TP-FMLs often requires too many processing steps and long-time cycles resulting in higher production costs and therefore restricting their usage to high-value-added products. Further, the success of the use of TP-FMLs as hybrid functional light-weight structural composite materials depends predominantly on the development and the availability of an end-of-life recyclability mechanisms and an efficient and automated and affordable manufacturing technology as a key requisite for large-scale production.

In this regard, The MatDeMA project focus on the manufacturing of a cost effective and recyclable inverse hybrid laminate composites consisting of a metallic sheet alloy stacked between two fiber-reinforced thermoplastic composite layers, supported by using an automated processing line and an end-of-life debonding-on-demand solution. The technology is benchmarked using a hybrid laminate (PA6GF/AL/PA6GF) consisting of an aluminium sheet (AL) and polyamide-6 reinforced glass fibres (PA6GF) as a reinforcement.