Affordable nanoreinforced composites for high volume manufacturing through automated design and processing technology

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This research summarises a review of the strategic developments for composite materials, automated design and processing technology that aims for affordable manufacturing supply chains in serial automotive or aerospace. A range of materials and automation technologies have been analysed, with practical case studies demonstrated the integration of technology into full scale manufacturing process and system (Fig. 1). With further technology advancements key achievements are 40% cheaper and lighter CFRP materials design and processing alongside the efficiency (below 5 min tact time) and 40% lower costs of automated manufacturing process, 25% improvement in CO_2 footprint over Out-of-Autoclave processing of CFRP materials, new automated materials technology and materials handling equipment tailored for composites production.

Materials technology strategy for Europe funded through H2020 programmes could present the opportunity for the leading OEMs to validate concepts on real car structures through commercial exploitation for next generation vehicle architectures. This suggested that key directions of R&D efforts could be aimed on the following: i) high volume, fast-cure resin for prepreg and smart processing, ii) automation of materials design, processing and assembly, iii) formulated materials systems and functionalized carbon fibres, iv) testing and modelling of materials, and v) recovery of prepreg and dry fibres and life cycle assessment. Multi-industry technology investments and EC funding may focus on high performance composite materials / CFRP to replace and/or integrate with metal structures.

Life-cycle analysis performed helped for optimized processing and production cycle with much lower carbon footprint and reducing waste produced during the manufacture of high-performance composite components. The main contributions and novelty of research include (I) the possibilities for further advances in materials systems and composites; (II) development and optimisation of materials technology, tooling and processing approach to CFRP materials, and (III) multi-physics modelling approach to support design and engineering with validation of measurements. Support from FP7 under MAGFIS project, FP7-PEOPLE-2013-IIF. GA Nr 913974 is acknowledged.