Hierarchical Graphene-based Polymer Composites for Automotive Applications: Challenges in the Way Forward

Prof. ***Ahmed Elmarakbi****, Automotive Composites, University of Sunderland, UK*

Abstract:

The automotive industry is widely viewed as being the industry in which the greatest volume of advanced composite materials will be used in the future to produce light vehicles. Nowadays, several advanced materials are widely used in automotive industry. Because of its multifunctional properties and promising applications, many expectations in composite materials are related to Graphene. However, no application of graphene-based materials is currently marketed in the automotive sector. Therefore, research activities are under development for study the potentiality of these systems and all the value's chain of automotive needs to be involved in this effort. One of most challenge aim is the economic impact of the innovative structures on the vehicle market, all the value's chain have to address their effort to get as low as possible the final cost of the innovative products.

The present initiative provides a summary overview on Graphene Related materials (GRM) for automotive applications and investigates efficient ways to integrate Graphene as polymer reinforcements within composite materials for energy-efficient and safe vehicles (EESVs). An approach that starts from the nano-scale through the Graphene elaboration by experiments to meso/macro-scale by continuum mechanics modelling is discussed with respect to some limiting factors in terms of the large scale production, the interfacial behaviour, the amount of wrinkling and network structure. Finally, a strategy for modelling such a composite is elaborated in the framework of the Graphene Flagship to well understand such limitations for a full applicability of Graphene. It is anticipated that this initiative will advance innovative lightweight graphene composites and their related modelling, designing, manufacturing, and joining capabilities suitable for automotive industry which requires unique levels of affordability, mechanical performance, green environmental impact and energy efficiency. This leads to complete understanding of the new graphene composites and their applicability in high-volume production scenarios.

Keywords: Automotive applications, Composite modelling and design, Energy efficient and safe vehicles, Graphene, Graphene composites