Abstract ID-PL03

NOVEL COMPOSITE MATERIALS FOR AUTOMOTIVE APPLICATIONS: CONCEPTS AND CHALLENGES FOR ENERGY-EFFICIENT AND SAFE VEHICLES

Ahmed Elmarakbi

Dept. of Computing, Engineering and Technology, Faculty of Applied Sciences, University of Sunderland, Sunderland SR6 0DD, UK
ahmed.elmarakbi@sunderland.ac.uk

Summary: The global automotive industry is currently facing great challenges, such as responsibility for increasing CO2 emissions, lack of strong decarbonisation targets, and safety issues. It is also 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.

Over recent decades, cars have become larger and heavier with every new generation. The main drivers of such a weight increase have been the improved safety and comfort requirements. Decades of R&D investments from the car industry and its supply chain to tackle this tendency have resulted in a substantially increase in the weight-specific performance of components and assemblies in terms of cost, strength and stiffness. Striving for reduced weight as the only objective will not necessarily result in a reduced environmental impact of the future vehicles: Another two key and equally important drivers need to be pursued at the same time, namely affordability and life cycle impact minimisation. Affordability is essential since it will allow for larger portion of vehicles to adopt specific lightweighting solutions; and Life Cycle Impact effectively defines the total CO2 impact over the lifetime of the vehicle, including the intrinsic CO2 emitted prior to the use-phase of the vehicle.

The development and manufacture of energy-efficient and safe vehicles (EESVs) is a great solution to the challenges faced by automotive industry. The main goal is that the future EESVs is achieved by a combination of novel materials concepts with safety design approaches through the development and optimisation of advanced ultralight composite materials, efficient fabrication and manufacturing processes, and life-cycle analysis to reduce the environmental impact of the vehicle. Nowadays, several advanced materials are widely used in automotive industry; however, vehicle safety is usually compromised due to lightweighting. Due to the fundamental trade-off between light efficient vehicles and safety standards, new directions need to be adopted to overcome safety issues. Several attempts have been made to strengthen vehicle structure to enhance crashworthiness, however, safety issues remain the main obstacle to producing lighter and greener cars. Therefore, the need to discover new directions for greener and safer vehicles is a must for significant contributions to an accelerated market introduction of new energy-efficient and safe vehicles. The development of novel composites materials, including the wonder materials "Graphene", and their potential applications in automotive industry will be investigated and discussed for future applications towards safer and greener transport..