

Prepreg formulation with graphene related materials

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Prepreg composite laminates formulated with thermoset epoxy resins and reinforcing carbon fibre fabrics curable by autoclave processing are widely used for manufacturing aeronautic parts.

The economic analysis of composites reinforced with carbon, glass or aramid fibre fabrics points out that the price of the selected materials is one of the main barriers for high performance composite design. In order to contextualize the cost of every material and processing step in composites designed for transport applications, it is necessary to consider the available budget for every saved kilogram in the final part. In the case of aeronautic applications this figure is about 450 €/kg, whereas in the case of aerospace industry it could be as high as 10.000 €/kg. However, for the case of automotive industry in most cases it is lower than 10 €/kg. Therefore, not every industrial sector and transport company could afford the same composite manufacturing techniques and materials for producing their parts.

Some sport goods, railway and automotive parts producers have implemented prepreg formulations curable out of autoclave. This is a highly competitive technique both from the technical and economical point of view, since it is just necessary to lay-up the preimpregnated composite layers in the mould followed by compression moulding or vacuum heating for curing. Parts produced by these procedures would benefit from mechanical properties improvement, lightening capability, corrosion and fatigue resistance at competitive prices.

The use of graphenic materials from Grupo Antolin for reinforcing hierarchical composite laminates has been studied for infusion and hand lamination techniques [1]. GAIKER has large experience in prepreg formulation and composite manufacturing technologies. Therefore a collaboration between both partners have been established in order to study the influence of dispersing graphene related materials in the thermoset resin before impregnating the reinforcing fibre fabrics for preparing the final prepreg formulation.

Depending on their components prepreg formulations would allow the development of composite structures presenting high mechanical properties, low density, fire resistance, different curing characteristics, etc. Tailored prepreg composites could then be developed in order to fulfil the requirements of the final part and manufacturing process.

The main objective of the project is to attain similar improvements in mechanical properties to those obtained by infusion moulding techniques in hierarchical composites. Prepreg formulations for automotive applications containing GRM from Grupo Antolin have been developed avoiding the usually reported processing problems related to viscosity issues and filtering effect in hierarchical composites containing carbon nanotubes or graphene platelets. Improvements in impact properties, crack propagation resistance, interlaminar fracture toughness, etc. have been obtained. This collaboration is being carried out within the **CDTI funded project "Smart Personal CO2-free Transport" (SPECTRA)**.

References

- [1] D. R. Bortz et al. *Macromolecules* 45 (2012) 238-245.
- [2] H. Zhang et al. *Composites Science and Technology* 139 (2017) 138-145.