Integration of graphene in carbon fibre reinforced polymers for aircraft applications

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Abstract

The use of carbon fiber reinforced polymers (CFRPs) for structural applications is widespread in the aircraft industry. One of the main research lines for these materials is focused on increasing the multifunctionality, either modifying the polymer matrix or using multifunctional coatings.
Some potential applications of graphene within CFRPs for the airframe include health monitoring, improved barrier performance, surface technology (anti-ice / de-ice, anti-erosion, anti-static…), functionality (lightning strike protection, EMI shielding, damping, thermal conductivity…) and system integration [1-4].
In this study, graphene nanoplatelets are introduced in different thermoset polymers for different manufacturing technologies. In particular, an epoxy resin for unidirectional carbon fiber prepreg and a benzoxazine resin for infusion have been used as matrix for CFRPs.
In the case of the epoxy prepreg, different types of graphene have been dispersed in the resin before the impregnation of the unidirectional carbon fiber tape. Flat planels with different stacking sequence have been cured in autoclave and then machined for mechanical characterization.
In addition, different contents of reduced graphene oxide nanoplatelets have been added to a benzoxazine resin that has been then used for manufacturing composite panels using either infusion or wet lay-up. In this case, a carbon fiber fabric has been selected. The mechanical performance is very similar to that of the reference panel (without graphene). An improvement in the barrier behaviour has been observed, with a reduction of 6% in the water uptake during immersion in hot water (figure 1).

References

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Figures

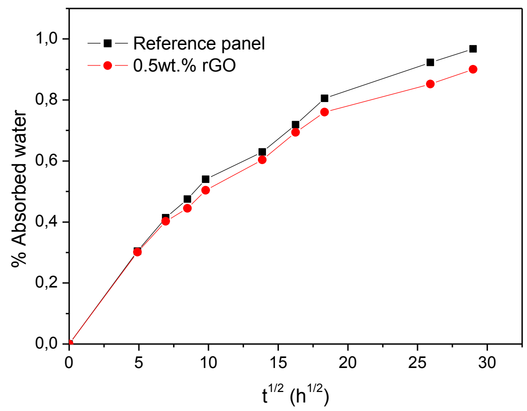

Figure 1: Water uptake in hot water