O76 CFRP laminates enhanced with graphene nanoparticles in multifunctional applications

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Abstract

In automobile, aeronautical, aerospace, sports and energy fields, there has been an increase of the use of carbon fibre reinforced polymers (CFRP) due their considerable advantages, such as, low weight, static and fatigue strength as well as corrosion resistance[1]. The addition of nanoparticles, in particular carbon allotropes, like graphene nanoplatelets (GNP) or carbon nanotubes (CNT) allow not only enhanced mechanical performance[2], but also can alter the electrical conductivity response of the CFRP composite system[3]. While the carbon fibre is conductive, the epoxy is not conductive, and the aleatory dispersion of the nanoparticles should introduce in the composite system considerable changes in electric conductivity.

The present work intends to study the effect of GNP on the mechanical response of composite laminates, and for this purpose CFRP laminates with and without GNP were manufactured and characterized in terms of flexural and viscoelastic behaviour. Furthermore, electric conductivity tests were performed to investigate the influence of the GNP in the electric response. The results obtained, show that the addition of GNP amounts up to 0.75 wt. % to the epoxy matrix improved the flexural results (Figure 1a). Concerning the electromechanical properties, it was possible to conclude that both laminate composites, with and without GNP, presented reproducible piezoresistive response, with a negative relative change in resistance ($\Delta R/R_0$) with increasing strain (ε), which may allow the health monitoring of the structure (Figure 1b).

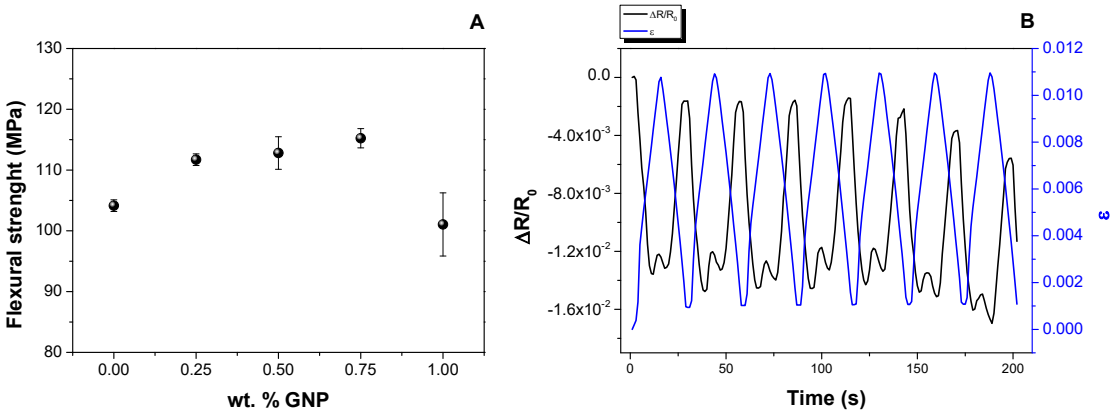

Figure 1. Effect of GNP wt. % on the bending strength (a). Piezoresistive response of the 0.75 wt. % GNP composite (b).

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