Electrical investigation by Tunneling Atomic Force Microscopy of carbon fiber-reinforced panels manufactured by modified Resin Film Infusion

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Abstract.

The purpose of this work is the electrical current map investigation by Tunneling Atomic Force Microscopy (TUNA) of carbon fiber-reinforced panels (CFRPs) impregnated with a multifunctional epoxy formulation containing glycidyl polyhedral oligomeric silsesquioxane (GPOSS) for improving flame resistance and multi-wall carbon nanotubes (MWCNTs) to prevent the electrical insulating properties of the epoxy resin. The multifunctional panels were manufactured by an appropriately modified resin film infusion (RFI) process. The effects of the different ply numbers (7, 14 and 24) on the TUNA electrical performance were assessed. In particular, TUNA technique, which is able to detect ultra-low currents ranging from 80 fA to 120 pA [1-3], allowed the identification of the conductive paths which are represented by carbon nanotubes that are firmly anchored to the carbon fibers with the characteristic aptitude to amass in the areas through which the transit of the resin occurs due to the particular infusion process. In this work, for all the manufactured panels, TUNA current images highlight the presence, between the layers of carbon fibers, of conductive three-dimensional networks of carbon nanotubes that take part successfully to ensure the good electrical performance of the multifunctional panels suitable for advanced structural applications.

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References

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