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Improvement of CFRP electrical conductivity by applying nano enabled products containing carbon nanotubes

Anna Boczkowska and **Paulina Latko-Durałek**
Warsaw University of Technology, Poland

Due to their low weight and high mechanical performance, carbon fiber reinforced polymer (CFRP) is used in the aerospace, automotive and defense industries. In comparison to metal parts, they can reduce total mass but cannot reduce electrostatic discharge or protect against lightning strikes. Therefore, a new challenge is to find a way to improve the electrical conductivity of CFRP, especially throughout its thickness. The most promising idea is to use carbon nano tubes (CNTs), which show not only high electrical conductivity but also good thermal conductivity and mechanical strength, while maintaining low density. There are different approaches to introducing CNTs into CFRP in manufacturing. One such approach is mixing the resin with CNT powder before performing the infusion. However, the significant increase of resin viscosity in the presence of CNTs makes the infusion process difficult. Another way is to bond CNTs covalently onto carbon fabrics. A more convenient way is to apply nano-enabled products such as thermoplastic non-woven fabrics containing CNTs (CNT-doped veils). The first manufacturing method involves the production of fibers and their thermal bonding; the second way is direct melt blowing of thermoplastic polymers doped with CNTs. Implementation of both types of non-woven fabrics in CFRP as inter layers by pre-preg and resin infusion results in good impregnation. When compared to the reference CFRP, the addition of CNTs increases the electrical volume conductivity throughout the panel thickness by as much as 350%. The obtained results are very promising for the further application of CFRP with CNTs as novel, lightweight and conductive structures for the replacement of metallic parts in many industrial sectors.

Recent Publications:

1. Gaztelumendi I, Chapartegui M, Seddon R, Florez S, Pons F and Cinquin J (2017) Enhancement of electrical conductivity of composite structures by integration of carbon nanotubes via bulk resin and/or bucky paper films. Composites Part B: Engineering 122:31-40.
2. Lopes P E, van Hattum F, Pereira C M C, et al., (2010) High CNT content composites with CNT bucky paper and epoxy resin matrix: Impregnation behavior composite production and characterization. Composite Structures 92(6):1291-1298.
3. Akcin Y, Karakaya S and Soykasap O (2016) Electrical, Thermal and Mechanical Properties of CNT Treated Prepreg CFRP Composites. Materials Sciences and Applications 7(9):465-483.
4. Islam M S, Deng Y, Tong L, et al., (2016) Grafting carbon nanotubes directly onto carbon fibers for superior mechanical stability: Towards next generation aerospace composites and energy storage applications. Carbon 96:701-710.

Biography

Anna Boczkowska is an Associate Professor in the Faculty of Materials Science and Engineering at Warsaw University of Technology in Poland. She has completed her Graduation from the same faculty in 1989 and completed her PhD in 2000 and DSc in 2011. Her scientific experience is related to the processing and structure of polymer matrix composites, nano composites and smart materials and industrial background of over 15 years in the development and application of polymers and composites. She is a member of many international organizations (e.g., ACS, AAAS, and SPIE) and author of numerous scientific publications, books and patents.

anna.boczkowska@inmat.pw.edu.pl

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