PO1066

Cold Atmospheric Pressure Plasma treatment of PEEK and PEKK based composite for aeronautical purposes

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Carbon Fiber Reinforced Polymer (CFRP) using thermoplastic polymer matrices are increasingly being used in structural engineering, particularly in aeronautics, due to their light weight coupled with high mechanical properties. Poly-etheretherketone (PEEK) and poly-etherketoneketone (PEKK) matrices composites are especially interesting because of their excellent physical and chemical properties, including high thermal stability, high chemical resistance and their ability to withstand high mechanical load. In most applications, the adhesive bonding or the covering of these composites by an additional coating is required. However, the low surface energy and the high chemical resistance of PEEK and PEKK CFRP imply to develop surface activation aiming at increasing their surface reactivity before painting. Among them, atmospheric pressure cold plasma has been widely studied and has shown to be an effective process to improve wettability and surface energy of thermoplastics. Moreover, this technology attracts many industrials looking for a cost-effective and eco-friendly surface activation process. The possible implementation of the atmospheric plasma in a production line without significant changes is also an advantage for its deployment. In this work, we have used a remote atmospheric pressure cold plasma (ULS - AcXys Technologies) to treat large surface of PEEK and PEKK CFRP, in order to improve the adhesive bonding between CFRP and an aeronautical coating. More precisely, the influence of discharge and process parameters (gas process, gas flow rate, discharge power, distance between nozzle and substrate, scanning speed...) on the surface properties is investigated. Chemical composition analyzed by X-ray Photoelectron Spectroscopy and morphology and roughness determined by Atomic Force Microscopy are discussed with respect to surface energies obtained by contact angle measurements. Ageing of the surface following the plasma treatment is also considered, using four storage conditions representatives of industrial environment.

Keywords
surface activation before painting
wettability
adhesive bonding
ageing