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Metallization of Carbon Fiber Reinforced Polymers: Chemical Kinetics, Adhesion, and Properties

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Abstract. In the present study, we investigate different surface pretreatments and their influence on a subsequent surface metallization. A direct liquid injection metalorganic CVD (DLI-MOCVD) process is presented for the low temperature metallization of composites, ultimately aiming at the surface functionalization of 3D parts. The process involves the organometallic precursor Cu(I) hexafluoroacetylacetonate 2-methyl-1-hexene-3-yne (hfac)Cu(MHY). We determine chemical kinetics of the global deposition reaction and show the improvement of the adhesion of the Cu films by applying surface pretreatments that etch and/or activate the surface before deposition. To this purpose, gas phase and wet chemical processes are used. Gas phase pretreatments consist either in the use of a remote microwave plasma, an in situ UV oxidation, or in the deposition of acrylic acid/ethylene plasma buffer layer by using an atmospheric pressure cold plasma jet. The liquid phase pretreatment is based on a commercial series of solutions that includes swelling, oxidation, and neutralization steps. The adhesive strength of the Cu films on poly-epoxy and on carbon fiber/poly-epoxy composite surfaces is specifically investigated by scratch and cross-cut testing, and is correlated with topographical, chemical, and energetic characteristics of the surfaces prior

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