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

Fouzi Addou, Thomas Duguet, Piera Bosso, Anne Zhang, Eliane Amin-Chalhoub, Fiorenza Fanelli, Constantin Vahlas

PII: S0257-8972(16)30767-8
DOI: doi: 10.1016/j.surfcoat.2016.06.098
Reference: SCT 21464

To appear in: *Surface & Coatings Technology*

Received date: 1 April 2016
Revised date: 13 June 2016
Accepted date: 30 June 2016

Please cite this article as: Fouzi Addou, Thomas Duguet, Piera Bosso, Anne Zhang, Eliane Amin-Chalhoub, Fiorenza Fanelli, Constantin Vahlas, Metallization of Carbon Fiber Reinforced Polymers: Chemical Kinetics, Adhesion, and Properties, *Surface & Coatings Technology* (2016), doi: 10.1016/j.surfcoat.2016.06.098

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

Fouzi Addou[1,*], Thomas Duguet[1], Piera Bosso[2], Anne Zhang[1], Eliane Amin-Chalhoub[1], Fiorenza Fanelli[3], and Constantin Vahlas[1]

[1]CIRIMAT, Université de Toulouse, CNRS-INPT-UPS, 4 allée Emile Monso, BP44362, 31030 Toulouse, France

[2]Department of Chemistry, University of Bari "Aldo Moro", via Orabona 4, 70126 Bari, Italy

[3]CNR-NANOTEC c/o Dipartimento di Chimica, Università degli Studi di Bari "Aldo Moro", via Orabona 4, 70126 Bari, Italy

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

* Corresponding Author email: fouzi.addou@ensiacet.fr, tel.: +33 534 323 458