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Plasma activation of PEEK surfaces: effect of texture and surface energy on practical adhesion.

David Gravis[1], Fabienne Poncin-Epaillard[2], Jean-François Coulon[3]

[1]ECAM Rennes - Louis de Broglie, Bruz (Rennes), France [2]IMMM, Le Mans, France [3] ECAM Rennes - Louis de Broglie, Bruz (Rennes), France

david.gravis@ecam-rennes.fr

Thanks to their low densities and good mechanical properties, polymer composites are good candidates for metal alloys substitutes, especially for transportation industries. However, their surfaces are commonly endowed with poor surface energies, and thus show poor practical adhesion towards coatings. In this regard, we study how both modification of the surface topography and the surface chemistry by Electron Cyclotron Resonance plasma influence and emphasize the practical adhesion of metallic thin films on Poly-Ether-Ether-Ketone thermoplastic.
The goal of this study is to propose a route towards a simple model describing the combined influence of surface texture and chemistry processed by plasma. To simplify the interpretation, we first studied two different processes to separate the chemical and mechanical anchoring effects of surface adhesion enhancement. On one hand, we studied surface activation by atmospheric-pressure plasma – where surface topography modification was kept minimal to obtain the “only-chemical effect” on PEEK adhesion; on the other hand we studied the effect of texturation by infrared femtosecond LASER to obtain the influence of the exclusive surface patterning on PEEK adhesion.
In smooth ECR plasma conditions, PEEK activated surfaces revealed a similar behavior to that one observed with atmospheric pressure plasma, showing direct proportionality between wettability and practical adhesion. In more energetic ECR plasma conditions, PEEK surface texturation occurs under scales of order different to PEEK laser texturation. Our separate understanding of the two adhesion principles – chemical and mechanical – would allow us to grasp the complex behavior when they aggregate under vacuum plasma in order to further increase thin coatings adhesion on polymer surfaces.

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