

Cr^{VI}-Free anti-corrosion protection and adherence promotion through the grafting of organic underlayer with a diazonium salt

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Abstract : Cr^{VI}-Free anti-corrosion protection and adherence promotion through the grafting of organic underlayer with a diazonium salt

Hexavalent chromium (Cr^{VI}) which is at the basis of most of the treatments used to prepare the metallic surfaces before painting in aeronautic, is classified as carcinogenic, mutagenic and reprotoxic (CMR). The time for using Cr^{VI} will soon pass, and alternatives must now be found. For this purpose, PROTEC Industry, a major actor for technical surfaces treatment in aeronautics is associated with CEA, a public research agency recognized among others for its innovations in surface modification. The strategy that we selected is based on the grafting of an organic underlayer, the anchoring of the layer to the metal being ensured by a specific chemical function bared by the precursor, namely a diazonium. With the aim of adapting the process to the aeronautic branch, CEA and PROTEC have shared their knowledge, manpower, device and knowhow through the creation of a common laboratory supported by ANR and ANRT, in 2012. On the one hand, the process has been adapted to the specifications of the industrial partner regarding the use of chemicals to treat the surface: the collaboration has permitted to end up with an all aqueous solution process, that only requires low cost precursors. This has generated a joined patent between the partners. In addition, the spraying has been employed for the deposition of the organic layer in order to work on small aircraft parts as well as on fuselage panels and airfoil parts (parts higher than 10 meters). On the other hand, the standardized test procedures have been used to assess the quality of the underlayer. Satisfying results have been obtained regarding: (i) th e production of a visible underlayer and (ii) the corrosion resistance of the coating finally obtained (organic layers), as assessed by long time stays of the samples in salt fogs. Progress have still to be achieved to enhance the adherence of the paint on the film and filfiform corrosion results, as established by standardized scribe tests. By contrast with certain other alternatives, this process is a real technological breakthrough and proposes a green surface treatment which ideally fulfills the REACH requirement. Interestingly, the underlayer shows high activity for a long duration after its deposition, which simplifies the procedures by suppressing the constrains of painting the surface just after the treatment. This is a clear advantage of the diazonium approach, in comparison with the other new strategies such as those based on the sol-gel technology. Further work will aim at reaching simultaneously all the performance required.

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