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ABSTRACT:

Why and how to introduce particles into layers made by plasma electrolytic oxidation? Towards an alternative to the liquid route, the solid route

T. Czerwiec1,2, A.Maizeray1, C. da Silva Tousch1, G. Marcos1,2, M-P. Planche3, H.Liao3, L. Magnies1, G. Henrion1, J. Martin1,2.
1 Institut Jean Lamour, UMR CNRS-Université de Lorraine, Nancy, France
2 Université de Lorraine, LabEx DAMAS, F-57045 Metz, France
3 Université de Technologie de Belfort-Montbéliard, Sevenans, F-90010 Belfort, France

Plasma electrolytic oxidation (PEO) is a plasma-assisted electrochemical conversion technique used to grow a protective oxide layer on lightweight metals. It is very efficient on aluminium and aluminium alloys. This process, which makes it possible to create hard layers of ceramics, is very often associated with porosity with a consequent poor corrosion resistance. The areas of research related to PEO are very active and very inventive to improve the properties of the layers obtained by this process. One of the intensively explored avenues is the addition of particles to the electrolyte in order to obtain incorporation of the particles into the oxidized layer. After showing all the application potential of introducing particles into PEO layers, we will illustrate the liquid route through work carried out on the incorporation of carbon (multi-walled carbon nanotubes and black carbon) [1,3]. However, it is very difficult to incorporate particles deep into the layer following this route. A promising alternative consists of manufacturing layers containing aluminum and particles by cold-spraying (CS) technologies and carrying out oxidation superficial treatments by PEO. Such treatments were done using dispersed □-Al2O3 particles or t-ZrO2 stabilized with yttrium oxide or Rt-TiO2. Characterizations of the layers, carried out by scanning and transmission electron microscopy on cross sections, will be presented as well as tribology results. These results provide important information on the energetic aspects of the arc and soft regimes of the PEO process.

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