Adhesion Promotion Using Dry, Blast-Coating Process to Prime Metals

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ABSTRACT

As the use of composite materials continues to grow, there is an increasing need to integrate these components within metal structures. A convenient method to achieve this integration is by using a structural adhesive. However, the preparation of the metal surface for adhesive bonding can be a difficult process involving hazardous wet chemistries in a multi-step process.

ENBIO have developed a novel, green, ambient temperature one-step blast coating technique known as CoBlast. It uses a co-incident blast stream of abrasive and coating media to simultaneously remove the metal's passivating layer while depositing a primer coating on the newly-exposed reactive metal surface. ENBIO are investigating the use of the CoBlast process to apply REACH compliant adhesive primers for the Space sector as part of a H2020 activity – OSMOSIS: One-Step Modification Of Space Integrated Surfaces (757088).

The surface treatment produces a typical coating thickness of 2-5µm and by altering the process conditions, the texture can be tuned to modify the surface roughness from between 0.5 and 5µm Ra (arithmetic mean roughness).

To date, a range of coating chemistries and surface finishes have been tested to demonstrate the adhesion promotion benefits of the CoBlast primer compared against commercial conversion coatings.

To determine the adhesion promotion benefits of the CoBlast coating, a range of lap-shear tests were conducted and samples were compared against commercial conversion coatings. Samples were characterised using surface profilometry, SEM, EDX and cross sectional light microscopy. The adhesive joints were also tested under different environmental conditions including 'as bonded', salt-fog exposure and humidity aged. CoBlast primed surfaces exhibit cohesive failure, for each exposure environment and can achieve equivalent tensile strengths to commercial conversion coatings.

Adhesive testing is on-going and CoBlast Prime is currently being evaluated for aluminium-to-aluminium honeycomb sandwich panels under climbing drum peel testing.