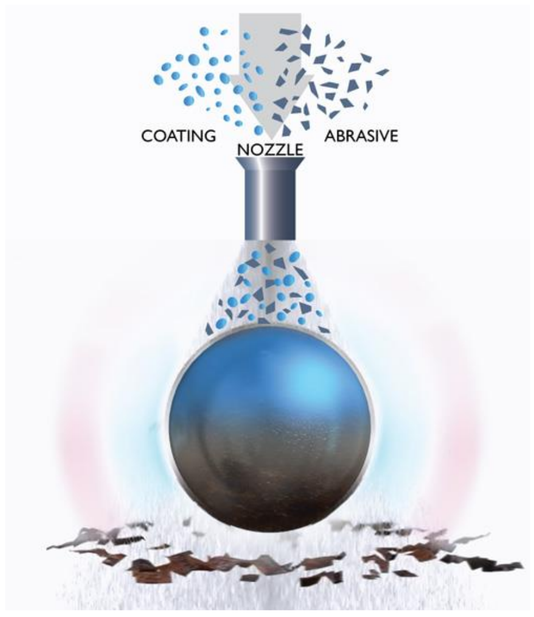
Adhesion promotion using dry, blast-coating process to prime metals

ENBIO™

Introduction

ENBIO have developed a novel, green, ambient temperature blast coating technique known as CoBlast (Figure 1). It uses a co-incident blast stream of abrasive and coating media to simultaneously remove the metal's passivating layer while depositing a coating on the newly-exposed reactive metal surface. The process is carried out at room temperature and pressure using dry-compressed air. The process is currently used to apply thermal control coatings for Space for ESA as part of the Solar Orbiter mission.



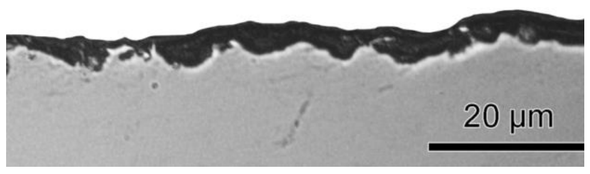


Figure 1: *Schematic of the CoBlast process (left) and cross-section of CoBlast treated metal surface indicating coated layer and texture*

CoBlast involves an abrasive and dopant material passing being fed through a nozzle used dry-compressed air. The resultant bond between the dopant and metal substrate is a tribo-chemical bond [1]

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 (757088). To determine the adhesion promotion benefits of the CoBlast coating, a modified lap shear test was conducted and samples were compared against commercial conversion coatings. CoBlast primed surfaces exhibit cohesive failure, for each exposure environment and can achieve equivalent tensile strengths to commercial conversion coatings (Figure 2).

The CoBlast surface treatment produces a coating typical coating thickness of 2-5 µm. Due to the abrasive nature of the process, repeat passes remove the already deposited coating and no net increase in thickness is achieved. By altering the process conditions, the texture can be tuned to modify the surface texture from between 0.5 and 20 µm R_a (arithmetic mean roughness).

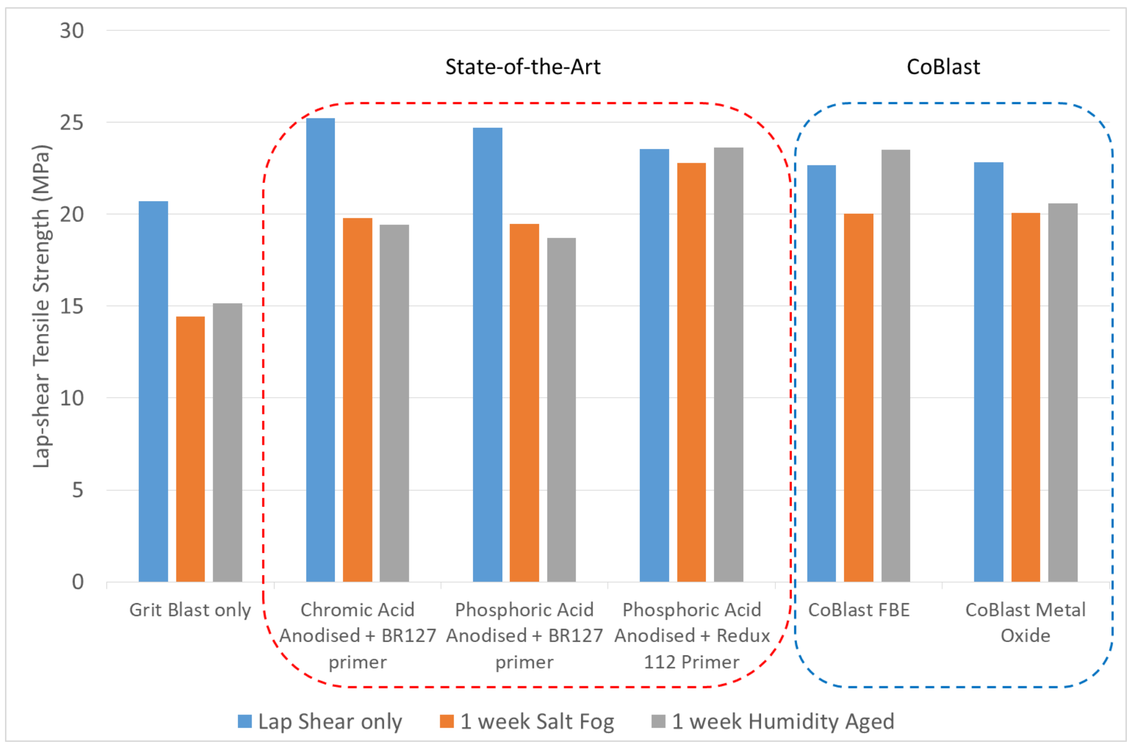


Figure 2: *Lap-shear data comparing Grit-Blast only, State-of-the-Art surface primer treatments, and CoBlast with an organic and inorganic dopant*

Based on the results to-date in the OSMOSIS project, CoBlast can provide equivalent performance to the State-of-the-Art surface primers without the need for wet-chemical treatment. A key advantage of the CoBlast process is the ability to treat any metal type (aluminium, steel, titanium, magnesium, copper, nitinol) and condition (cast, wrought, machined). The process is selective and only the area being bonded requires treatment. Beyond Space, the process has application in the Aerospace and Automotive sectors.

References

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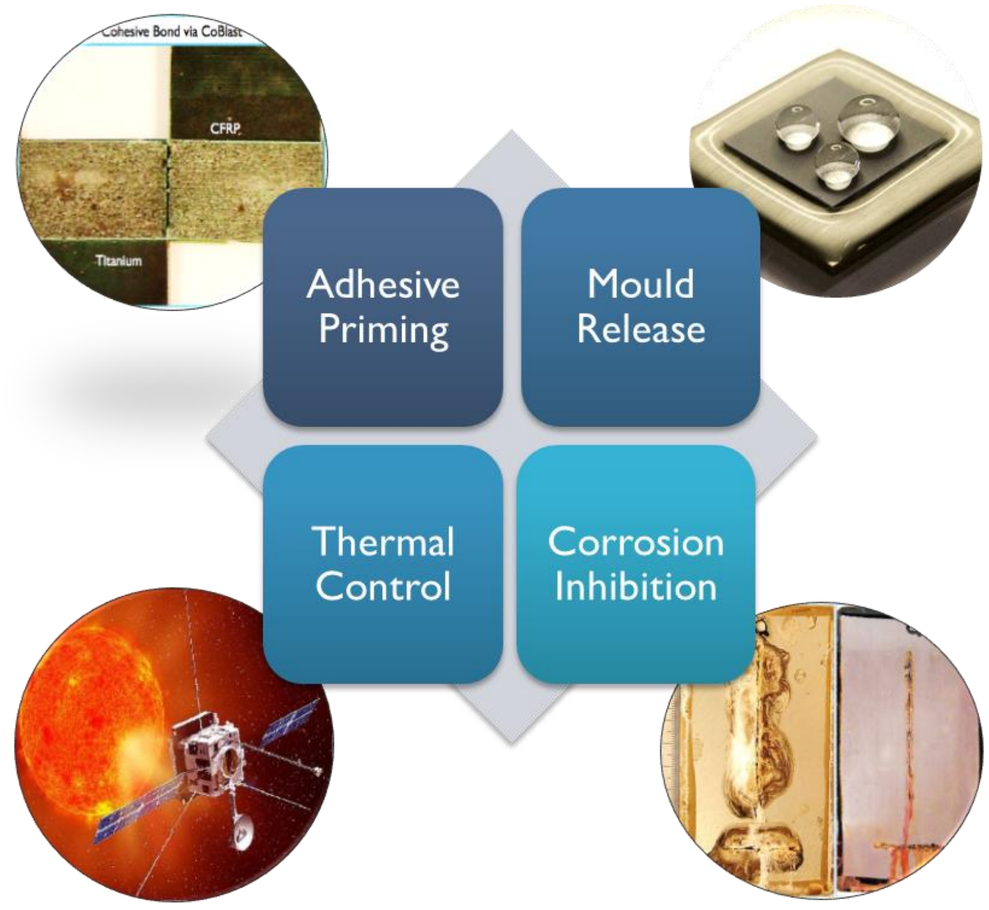
2. "Flat absorber coating for spacecraft thermal control applications", K.A.J. Doherty, C.F. Dunne, A. Norman, T. McCaul, B. Twomey, and K.T. Stanton, Journal of Spacecraft and Rockets (special issue from ISMSE), 53 (6), 2016, 1035-1042
3. "High-temperature solar reflector coating for the Solar Orbiter", K.A.J. Doherty, B. Twomey, S. McGlynn, T. Raftery, N. MacAuliffe, A. Norman, T. McCaul, C. Semprimoschnig, B. Bras, P. Olivier, K.T. Stanton, Journal of Spacecraft and Rockets (special issue from ISMSE), 53 (6), 2016, 1077-1084

Company

ENBIO is an SME based in Dublin, Ireland that develops innovative R&D solutions for multiple sectors. ENBIO has been developing novel surfaces for the space sector since 2011 with thermal control coatings being the first adopted technology by a European Space Agency as part of the Solar Orbiter mission [2,3]. ENBIO's technical team includes a core of dedicated research and production engineers supported by contracted advisors. The team has the skills and experience to develop technologies from basic research stages right through to production, with more than 150 years of combined experience in a wide range of areas. More recently, ENBIO has been developing release surfaces using fluoropolymer coatings for tire and silicone moulds; REACH compliant adhesive primers for metals to replace wet-chemistry alternatives; and anti-galling treatments for bolts and fasteners to achieve equivalent performance after re-use.



CAST - ACTTiVAte

ENBIO are also engaged is a technology transfer project with the ACTTiVAte (6 to develop and commercialise a new treatment for bolts and fasteners. CoBlast is used to apply anti-stick coatings onto titanium and stainless steel bolts. During assembly, the thread sections of the bolts can stick and 'cold-weld' to the internal thread surface causing galling. CAST (Conductive, Anti-Stick Treatment) for bolts and fasteners used in the Space and Aerospace sector is ENBIO's answer to that problem. Harmful, aerosol release coatings are currently used in the sector to minimize galling and reduce the possibility of bolt-shearing, but are not achieving the required bolt tension for an applied torque. The CAST product utilizes the CoBlast process to apply a low-friction, anti-stick fluoropolymer coatings to the thread section on bolts to minimize galling and ensure consistent performance for up to 50 reuses (see Figure 3).

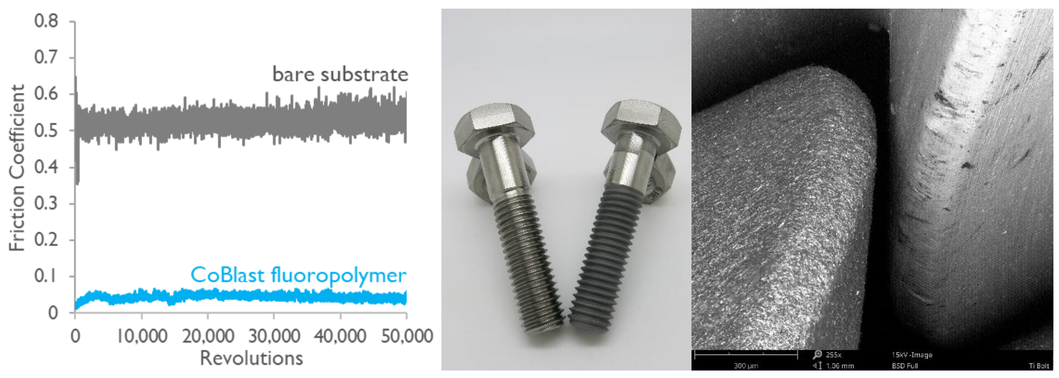


Figure 3: *(Left) Friction performance of CoBlast fluoropolymer coating versus uncoated stainless steel substrate; (Middle) uncoated and PTFE CoBlast coated titanium bolts; (Right) scanning electron microscope image of uncoated (right) and coated (left) thread profile*

EUREKA innovation across borders

ENBIO have secured H2020 and Eureka funding and are actively looking for opportunities to collaborate.

HORIZON 2020

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