ANTI-GALLING TREATMENT FOR BOLTS AND FASTENERS

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ABSTRACT

CoBlast, an abrasive surface treatment technique developed by ENBIO LTD has been previously used to apply black thermal control coatings for use on spacecraft. However, the same process can also be utilised to deposit thin (1-3µm), well adhered low-friction coatings, Fig. 1. Titanium bolts are often used in the construction of spacecraft and satellites due to their high strength to weight ratio and good corrosion resistance. They are however more expensive than other metallic fasteners and are prone to galling and cold welding. These issues limit the amount of times a bolt can be reused as there is a question regarding the consistency of the bolt tension. Currently, Titanium bolts are sometimes used 2 to 3 times before they are disposed, resulting in massive scrap rates during the building process. A low friction grease or dry film lubricant spray is sometimes applied to improve this but there are often issues about consistency of application or thick coatings resulting in oversizing of the threads. This work describes the application of a selection of space compliant dry lubricant materials onto titanium bolts using CoBlast as a way to maintain consistent bolt tension during multiple uses and to reduce galling and cold-welding. This in turn will significantly reduce the cost associated with bolt scrappage and the difficulties associated with applying currently available commercial lubricants.

Surfaces are characterised before and after treatment using confocal microscopy, scanning electron microscopy and elemental analysis to ensure adequate coating coverage. CoBlast coated, Aerosol based MolyKote and uncoated samples were tested using a Futek compression cell to measure bolt tension. The bolts were torqued to pre-set values before being released fully. This cycle was repeated and the bolt tension recorded. Testing conducted on CoBlast coatings on other metallic fasteners have shown consistent bolt tension for greater than 100 cycles while the uncoated bolt has galled after 3 retightens.

Fig. 1: Left image: CoBlast coated Ti bolt (left) & uncoated (right). Right Image: SEM images of bolt thread section coated with PTFE (left) & uncoated (right).
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