

Composite Engineer's Viewpoint

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Mechanically Fastened Joints in Composite Structures Part 5 – Corrosion

In this article we will consider the bolted joint corrosion issue. The attachment of composite and metal structures with metal bolts can be a source of corrosion damage of the metal structure or bolt. However, with appropriate installation practices corrosion can be eliminated.

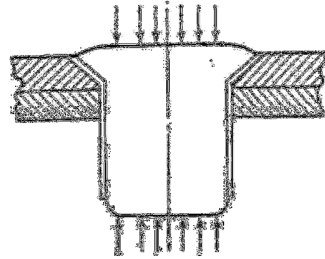
↑	Platinum
Noble or Cathodic	Gold
	Graphite
	Titanium
	Silver
	Hastelloy C (62Ni, 17 Cr, 15 Mo)
	18-8 stainless steel (passive)
	Chromium stainless steel
	Inconel (passive)
	Nickel (passive)
	Silver solder
	Monel
	Bronzes (Cu-Sn)
	Copper
	Brasses (Cu-Zn)
	Hastelloy B
	Inconel (active)
	Nickel (active)
	Tin
	Lead
	18-8 stainless steel (active)
Cast iron	
Steel or iron	
2024 aluminium	
Active or Anodic	Cadmium
	Commercially pure aluminium
	Zinc
	Magnesium and magnesium alloys
↓	

What we find is that most metallic components are prone to corrosion when in contact with graphite (carbon) composite materials. However Titanium is more resistant to corrosion and thus commonly the preferred material when working with composites such as graphite (carbon) fibre reinforced plastics. But we do connect other material to graphite (carbon) fibre reinforced plastics. Note on the list to the left that glass fibres are not listed. This is because glass fibres are corrosion potential inert.

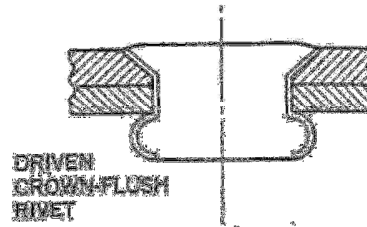
One of the possible ways to protect metals from corrosive potential when joined to graphite (carbon) fibre composites is to include a layer of glass fibre composites at the faying surface. This will provide the inert barrier between the graphite (carbon) fibre composite and the metal (anode). We should also be concerned with the bolt corrosion potential. Here Titanium bolt is the preferred fastening material for graphite (carbon) fibre composites. Also, if the bolted joint is through a potentially corrosive metal the fastener such be wet (sealant) installed for the corrosion protection.

There are several of methods of providing corrosion protection of bolted type joints. Several fastener types include the use of a corrosive protection sleeve, as shown.

EXPANSION OF RIVETS FILLS EVERY HOLE
PRECISELY, TO HELP WITH LOAD SHARING



SLEEVE IS A CORROSION BARRIER
AND PREVENTS SPLITTING WHILE
THE RIVET IS BEING FORMED

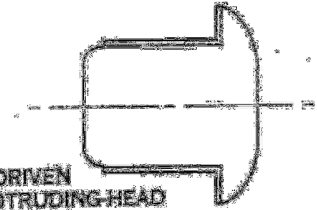


DRIVEN
CROWN-FLESH
RIVET

UNDRIVEN
SLUG-TYPE
RIVET



UNDRIVEN
PROTRUDING-HEAD
RIVET



In the next article we will discuss the fastener interaction (i.e. pull-through, bending) – there are significant factors to consider in the way a fastener interacts with a composite structure whilst under load. I also welcome questions, comments and your point of view. Feel free to contact me via r.heslehurst@adfa.edu.au. I may publish your questions and comments, and my response in future newsletters.
