

Anodizing Aluminum Alloys to Improve Wear Resistance

Although aluminum alloys and austenitic stainless steels are not good choices for use in gear or threaded applications because of their softness, some spacecraft designers persist in using them. In order to increase the hardness of the aluminum alloy surface, anodizing is often specified for gears and threaded components. Such anodizing is usually covered by Mil-A-8625, Type I and II for thin coatings ($\sim 0.5 \mu\text{m}$) and Type III for thick coatings ($> 25 \mu\text{m}$). In either case, the aluminum oxide coating that is formed on the surface is hard and wear resistant as long as it is not punctured or crushed. Accordingly, the surface finish should be of a fine quality ($<0.38 \mu\text{m rms}$) before the anodizing is applied in order to avoid low-strength asperities that can be easily crushed.

One of the common manufacturing errors that is encountered is that of anodizing the gear blank before the teeth are machined into it. Obviously in such a case, the gear teeth are left untreated and are, therefore, subject to early wear and failure. Naturally, the anodizing should be performed on the gear after final machining.

Similarly, threaded rings, collars, retainers, and the like, which are machined from aluminum alloys, should be anodized after the threads are formed or machined into the part.