

Metal Etching Methods



Etch Process Line

Overview & Applicability

Aluminum Etch

Aluminum etch can be used for both cleaning and inspection. An alkaline bath made of sodium hydroxide (NaOH) is used for etching aluminum parts.

Anodic Etch

Anodic etch is similar to anodic cleaning, however, the part is placed in an acid rather than an alkaline bath. Anodic etch is used as an inspection method to detect grain structure and segregation problems. It is applicable to stainless steels and nickel-based materials. Sulfuric acid is used for this etching process.

Blue Etch Anodize

Blue etch anodize (BEA) is a highly sensitive etch method for detecting material segregations in titanium. It is typically used for all aircraft rotating parts made of titanium. Please see our separate BEA process tech brief for additional details.

Macro Etch

Macro etch (a.k.a., Chemical etch) can be used for both cleaning and inspection. It is applicable to nickel and titanium based alloys. Macro etch as an NDT (Nondestructive Testing) method is used to expose grains for evaluation. As such, grains are inspected for size and flow as well as overheat conditions. Note that macro etch can be used to detect material segregations in nickel-based alloys (i.e., white spots, "freckles", in black smut condition). It can also be used detect gross material segregations in titanium, however, is not nearly as sensitive as BEA.

Nital Etch

Nital etch (a.k.a., Surface Temper) is similar to anodic etch but is only applicable to steels (i.e., not applicable to nickel-based alloys). Nital etch is primarily used to detect grinding and proper case hardening (i.e., carburization) conditions. Nital etch is performed using nitric/hydrochloric solutions.

Summary

<i>Material</i>	<i>Aluminum</i>	<i>Carbon Steel</i>	<i>Stainless Steel</i>	<i>Nickel</i>	<i>Titanium</i>
Etch Type					
Aluminum	X				
Anodic			X	X	
Macro				X	X
Nital		X	X		
BEA					X

Note that the selection of one type of etching method over another for the same material is typically just customer preference. BEA over Macro etch is the one exception; BEA being more sensitive to material segregations.



Rinse Step after BEA

Follow-on NDT

Etching as an NDT method will detect indications on a macro level. When additional information about the nature of the indication is desired, it is common to then perform a replication for micro-analysis (see related process tech brief sheet).

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