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Brief 66-10110

NASA TECH BRIEF

Etching Process Mills PH 14-8 Mo Alloy Steel to Precise Tolerances

The problem:

To develop a process for precision removal of excess metal from PH 14-8 Mo alloy steel in the annealed condition and in the aged condition, or to shape the alloy to exact tolerances that would be difficult to obtain with normal machine shop practices. Chemical milling is an established technique in working with softer metals but is difficult to control when used for hard alloys such as PH 14-8 Mo.

The solution:

A chemical milling process that produces finishes on PH 14-8 Mo alloy to precise tolerances by combining an aqua regia etchant with a sulfonate wetting agent.

How it's done:

The PH 14-8 Mo alloy steel in annealed or heat-treated condition is subjected to a chemical etchant solution that is held at a temperature of 140° to 145°F. Portions not to be etched are covered with a neoprene-type mask that provides good etch line definition. Metal removal of the exposed surface is at a uniform rate of approximately 0.6 mil per minute. To chemically mill a skin of this alloy to very thin web sections (0.006 inch to 0.008 inch), the skin is placed horizontally with the etchant solution in contact with the upper surface only, so that the reaction gases may disperse unimpeded. These gases are highly corrosive and can disfigure any surfaces contacted. A dodecylbenzene sulfonic acid wetting agent is used in conjunction with the highly corrosive, aqua regia type etchant solution. This enhances the wettability of the etchant solution and results in a more controlled interfacial reaction between solution and metal surface.

Notes:

1. This method permits work to exacting tolerances with surface roughness controlled within 40 to 60 microinches RMS. Conventional machining produces surface roughness of 60 to 125 microinches RMS.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas, 77058
   Reference: B66-10110

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

Source: Patrick W. Mulland and Benny L. Chipman
of North American Aviation, Inc.
under contract to
Manned Spacecraft Center
(MSC-270)

Category 03