NASA TECH BRIEF

Effects of Hydrogen on ELI Titanium Alloy Ti – 5Al – 2.5Sn

The effects are reported of hydrogen on ELI titanium alloy Ti–5Al–2.5Sn under three sets of conditions.

1. Tensile tests followed abrasion under hydrogen, and temperature cycling between -423° and either 400° or 800°F. The metal was abraded with titanium, Inconel-718, 440-C, Tens-50 aluminum, A-286, or iron files. These treatments lowered the tensile strength by $\leq$21%, and increased ductility by $\leq$38.7% as measured by reduction in area. These effects are believed to be too great to reflect data scatter only. Effects of abrasion in air or helium were similar. The tensile tests revealed no evidence of embrittlement. Gas analyses and electron and light microscopy of the failed specimens showed no absorption of hydrogen, no formation of TiH_2, and no evidence of brittle fracture.

2. When the metal was fretted on itself in flowing hydrogen at ambient temperature and pressure, a powder formed that was identified as TiH_2. It is proposed that the fretting between two surfaces so raised the surface temperature that enough hydrogen was absorbed to form the hydride. The same fretting in air formed TiN and TiO_2 powders.

3. When the metal was abraded with an iron file in flowing hydrogen at 400° or 800°F, TiH_2 formed on the surface. Here the ambient temperature was high enough for absorption of sufficient hydrogen for formation of the hydride phase in the metal structure.

Notes:

1. This information may interest the aircraft industry, fabricators in titanium, and manufacturers and users of containers or handling equipment for cryogenic liquids and gases.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   Code A&TS-TU
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: TSP70-10366

Patent status:

No patent action is contemplated by NASA.

Source: W.E. Hensley and W.T. Chandler of North American Rockwell Corporation under contract to Marshall Space Flight Center (MFS-18815)

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