NASA TECH BRIEF

Brazing Process Using Al–Si Filler Alloy Reliably Bonds Aluminum Parts

The problem:

To develop an improved method for metallurgically bonding aluminum parts. Conventional fluxes which have been used for brazing aluminum evolve objectionable fumes in the brazing furnace and necessitate the expenditure of time and effort to remove excess flux after brazing is completed. Bonds formed between aluminum parts by the silver diffusion process often fail to pass high-pressure leak tests, and parts which pass the tests must be given a protective coating to prevent cathodic corrosion of the aluminum.

The solution:

A process employing an aluminum–silicon filler alloy containing from 7.5 to 12% silicon for diffusion bonding of the aluminum parts in a vacuum or an inert gas atmosphere.

How it's done:

Parts to be bonded are chemically cleaned to remove all contaminants from the mating surfaces. The cleaned surfaces may either be clad with the aluminum–silicon alloy or interleaved with this material. The filled parts are placed into an open steel envelope whose inner surfaces are separated from the parts by aluminum or steel sheets. The envelope is then sealed by welding its open edges to ensure leaktight joints, as determined by a helium leak test, and evacuated to eliminate gaseous contaminants. The evacuated envelope is heated by any suitable means to a temperature ranging from 1045° to 1110°F, which is then maintained for a sufficient time for completion of the diffusion bonding process. At the end of this time, heating is discontinued and the envelope is allowed to cool to room temperature. The envelope is then opened and the bonded structure is removed. The rate of cooling will depend on the configuration and mechanical properties of the completed aluminum structure.

Notes:

1. Parts of certain configurations may require that the envelope be purged and backfilled with an inert gas, instead of being evacuated.
2. This relatively inexpensive process is carried out at temperatures substantially below those required in conventional processes and produces bonds of greater strength and reliability.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas, 77058
   Reference: B66-10241

Patent status:

No patent action is contemplated by NASA.

Source: C. S. Beuyukian and Wayne R. Johnson of North American Aviation, Inc. under contract to Manned Spacecraft Center (MSC-448)

Category 05