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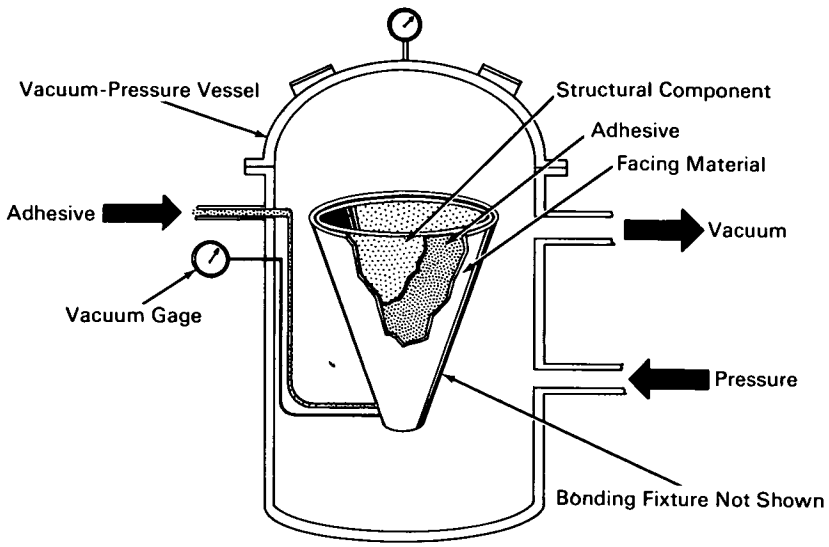
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

New Method Forms Bond Line Free of Voids



The problem: The advent of epoxy resins has greatly increased the use of adhesive bonding as a structural technique. In structural applications involving high vibrational, impact, or heat environments, voids or air pockets in the bond line introduce weaknesses that endanger the integrity of the bond.

The solution: A bonding method employing vacuum, pressure, and heat produces a bond line essentially free of voids or discontinuities.

How it's done: The structural component and facing material are prepared for the bonding operation by machining and measuring their interfacing surfaces as held in a bonding fixture to assure a minimum bond line gap of 14 mils. The assembled components and fixture, fitted with a reservoir dam, vacuum gageline, and adhesive feeder line, are placed in an oven and heated to 200° F. The complete assembly is removed from the oven and placed in a vacuum-pressure vessel heated to 200° F and the vacuum gageline and adhesive feeder line attached through the vessel wall to external counterparts. The vessel is evacuated and the proper quantity of de-aerated epoxy adhesive is forced into the bond line gap. The vacuum is relieved and the vessel is pressurized to 90 psi using dry nitrogen. The vessel is held at 200° F and 90 psi for the 16-hour curing period. Following the curing period the assembly is allowed to cool inside the vessel, which is maintained at 90 psi during this cooling cycle. The assembly is then removed from the vessel and fixture.

Notes:

1. X-ray inspection proved the bond line to be completely free of voids.
2. An ablation shield bonded to a magnesium structural component by this method has proven highly

(continued overleaf)

successful in simulated reentry tests involving great heat and air turbulence.

3. This method would be useful where the structural strength of metal is required but other surface materials are indicated by environmental conditions.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Langley Station
   Hampton, Virginia, 23365
   Reference: B63-10558

Patent status: NASA encourages the immediate commercial use of this invention. It is owned by NASA, and a patent application has been filed. When patented, royalty free nonexclusive licenses for its commercial use will be available. Inquiries concerning license rights should be made to NASA Headquarters, Washington, D.C., 20546

Source: Charles B. King
(Langley-20)