December 1967

Brief 67-10593

NASA TECH BRIEF

Solvent Permits Solid Curing Agents to be Used at Room Temperatures

The problem:

To determine the feasibility of using a solvent system for dissolving the solid curing agents used with polyurethane resins in adhesive systems. The bonds formed must be as strong, or nearly as strong, as in the prior method which used melted solid curing agents. This process was difficult to use in assembly line operations because of the necessity of melting the curing agent before it could be mixed with the base resin.

The solution:

Two polyurethane two-component adhesive pastes used in cryogenic bonding, each consisting of a solid adhesive curing agent and a resin were tested. The solid curing agents are normally melted at 250° F prior to mixing with the polyurethane resins.

The various solvents evaluated included: tetrahydrofuran, acetone, dimethyl formamide, and mesityl oxide. In the case of each solvent, the solid curing agent was stirred in until a saturation solution was formed. The resulting dispersed solvent was mixed with the applicable polyurethane resin until the mixture was homogeneous. Entrapped air and as much solvent as possible were then removed.

The various resin mixtures were applied to aluminum panels, which were then assembled for bond testing. The panels were allowed to cure for a minimum of 3 days at 2 to 3 psi pressure. The assembled panels were shear tested in a tensile testing machine at various temperatures between −423° F and 250° F. The bonds were also tested for thermal shock cycling and sustained exposure in liquid hydrogen.

A solvent dispersion system was developed which yielded bond strengths comparable to 100 percent solid formulations. The optimum solvent chosen was a 55.5 percent solution in anhydrous tetrahydrofuran. A saturated solution containing the curing agent was mixed in the ratio of 11:100 with the applicable base resin.

Notes:

1. The solvents used were mainly nonreactive diluents and as such extended pot life without appreciably increasing the set time. Tetrahydrofuran had the least detrimental effect on the mechanical properties of the cured adhesive.
2. The maximum amount of solvent must be removed from the resin mixture before the parts are assembled, making degassing and an extended open time essential.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B67-10593

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: M. C. St. Cyr
of Douglas Aircraft Company
under contract to
Marshall Space Flight Center
(MFS-13434)

Category 03