August 1969

Brief 69-10303

NASA TECH BRIEF

Quality-Weld Parameters for Microwelding Techniques and Equipment

An attempt to improve the reliability of microwelding by demonstration of a superior process employing capacitor-discharge equipment has been reported. This concept provides the basis for design of a new power supply or for modification of typical commercial-grade capacitor-discharge welding machines. This new limited-amplitude, controlled-decay (LACD) process expands the weldability of lead materials.

The LACD system consists in building a capacitor-discharge welder for control of the shape of the weld pulse; standard welders may be modified. Insertion of a variable impedance in the primary circuit enables selective control of the pulse's amplitude and length and of current decay.

Since the effect of impedance on weldability required thorough investigation, the effect of variation in impedance versus watt-seconds was examined at three representative isopressures selected from previously developed standard-isostrength diagrams. A complete watt-second weldability range was established for about eight impedance settings at each of the three isopressures.

The new process was evaluated by direct comparison with a standard welder; 12 combinations of typical component-lead materials were tested, including kovar, nickel, dumet, and OFHC copper. Preliminary and final qualification tests were run for establishment of valid bases of comparison of the two welding processes. By providing a better match with the power supply, the LACD method improved the weldability of all combinations tested except that of OFHC copper and nickel ribbon. On the basis of optimum scale utilization the improvement was from two-fold to fourfold; for example, 12-mil kovar, having a normal welding range of from 2 to 3 watt-seconds at a pressure of 5.5 lb on the low scale, was satisfactorily welded in the range from 50 to 100 watt-seconds on the high scale of the LACD welder.

During the tests OFHC-copper wire appeared to be more easily welded to nickel wire than to nickel ribbon; with the LACD method and nickel wire, ranges of 30 watt-seconds were easily achieved. The mass relation between the copper and nickel wires correlated mathematically with the observed LACD delta watt-second welding range. The new method requires no deviation from NASA's specifications for materials except that a barrier layer of nickel is essential on any gold-plated copper surface of materials such as dumet. Gold plating exceeding from 50 to 150 microinches in thickness restricts the range of weldability of dumet.

Notes:

1. The new technique may interest assemblers of electronic equipment.
2. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10303

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

Source: W. R. Hutchinson and L. G. Hall of
Martin Marietta Corporation
under contract to
Marshall Space Flight Center
(MFS-20484)