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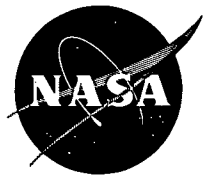

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Resistance Spot Welding of Dispersion-Strengthened Nickel Alloys

The Problem:

Develop an easily-applied production method for resistance spot welding a dispersion-strengthened nickel chromium alloy. The weld must be both indistinguishable from the parent material as determined by metallographic examination and as strong as the parent material in 1373 K (2012°F) stress rupture tests.

The Solution:

Use unrecrystallized sheet material, develop a welding schedule that will produce a solid-state spot weld without recrystallizing the sheet, and postheat to produce grain growth across the weld line during recrystallization of the sheet material.

How It's Done:

The Ni-20 Cr-2 ThO_2 sheet, 0.38 mm (0.015 inch) thick, is obtained from the manufacturer in the unrecrystallized condition (normally the sheet is recrystallized before shipment). The sheet material is cleaned, chemically etched, and stored in trichlorotrifluoroethane until just prior to welding.

Resistance spot weld the material in air with copper electrodes using a single phase, 400 KVA welding machine. The welding parameters are experimentally adjusted to produce solid-state spot welds without recrystallizing the sheet. (In conventional resistance spot welding, the parent material is melted to form a molten nugget.) Postheat the solid-state spot welds in a furnace at 1473 K (2192°F) for two hours in a hydrogen atmosphere. When recrystallization occurs, the original weld interface is obliterated by grain growth across it.

Stress rupture tests at 1373 K (2012°F) established that the welds produced by this procedure were as strong as the parent material. In no case did failure take place at the weld.

Notes:

1. This solid-state resistance spot welding method may be applicable to other alloys that undergo recrystallization or phase change reactions.
2. Although it was beyond the scope of this study, it is believed that high quality solid-state resistance seam welds could readily be made by substituting circular electrode wheels for the spot welding electrodes.
3. The study reported herein was primarily devoted to 0.38 mm (0.015 inch) thick sheet. Feasibility of applying these techniques to sheets 1.57 mm (0.062 inch) thick was demonstrated but no mechanical tests were made of spot welds in the thicker material.
4. Further information is available in the following report:

   NASA TN-D-7256 (N73-21443), Solid State and Fusion Resistance Spot Welding of TD Ni-Cr Sheet

   Copies may be obtained at cost from:

   Aerospace Research Applications Center
   Indiana University
   400 East Seventh Street
   Bloomington, Indiana 47401
   Telephone: 812-337-7833
   Reference: B73-10315
5. Specific technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B73-10315

Patent Status:

This invention has been patented by NASA (U.S. Patent No. 3,758,741). Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

NASA Patent Counsel
Mail Stop 500-113
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

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(LEW-12075)

Category 04

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