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Brief 68-10192

NASA TECH BRIEF

Welding of Commercial Base Plates Is Investigated

An investigation has been made concerning the effects of the metallic element composition and the internal hydrogen content of commercial 2000 series aluminum alloys upon welds in these materials. Welds were made bead-on-plate, using base plate thicknesses of 1/4 and 3/4 inch. The inert gas welding atmosphere was deliberately contaminated with water vapor at a dewpoint of about 0°F to produce a "baseline" amount of weld porosity. A limited number of welds were made with the addition of 4043 filler wire to 2014-T651 plate and 2319 filler wire to 2219-T87 plate. Welds were also made with the welding atmosphere at a dewpoint of about −40°F. Use of a radioactive isotope as a means of identifying hydrogen in the weld was evaluated during the investigation.

Welds were made in the horizontal position using precisely controlled equipment and finely calibrated instrumentation. Welds were examined by radiographic and sectioning techniques. Amount of porosity was the major item of interest and was quantitatively determined using point counting techniques on lightly etched transverse weld sections. Amount of porosity was related by statistical analysis to the composition of the parent metal.

The investigation demonstrated that the combinations of metallic elements with hydrogen were not capable of producing weld porosity themselves, rather they tended to increase the amount of porosity only in the presence of arc contamination by water vapor, a common troublemaker in welding. Hydrogen content of the welds was found to be directly related to alloy composition. Increased numbers of intermetallic particles did not seem to have any effect. Pores occurred preferentially at solute-depleted regions while nucleation and growth of pores were observed to be nonuniform. Welds of 2014 alloy fractured during test along the fusion zone boundary while the 2219 alloy welds fractured diagonally across the weld. Where gradual thermal gradients existed, base metal porosity occurred near the fusion zone.

Note:

Inquiries concerning this investigation may be directed to:

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Patent status:

No patent action is contemplated by NASA.

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