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NASA TECH BRIEF

Marshall Space Flight Center

X-Ray Opaque Additive for Inspection of Weld Joints

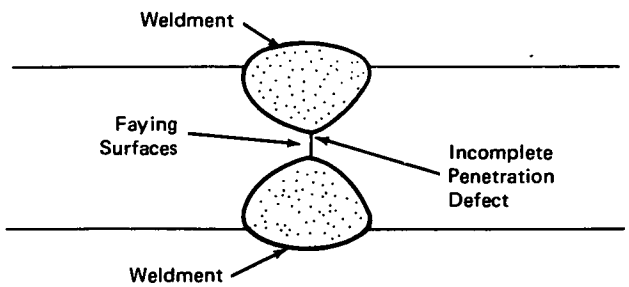

Figure 1. Incomplete Penetration Defect

The problem:

In thick-section aluminum-alloy weldments where at least one pass across each surface is necessary, it is possible to have a condition of incomplete weldment as shown in Figure 1. This defect forms a very tight crack running along the length of the weldment and is not visible from the outside. Because of the usually-high compressive residual stresses in the aluminum weld joint, the faying surfaces of the defect are pressed together very tightly. Therefore, the defect is often missed during inspection with X-ray or ultrasonic-wave-propagation techniques.

The solution:

A thin coating of copper applied to each faying surface of the aluminum-alloy improves the X-ray detection of the welding defects.

How it's done:

Because copper is more X-ray opaque than aluminum, it is used as coating at the faying surfaces of two aluminum-alloy sections prior to welding. It remains in its original state in a zone of incomplete weld penetration and therefore is readily detectable by film radiography inspection. This technique of using copper is

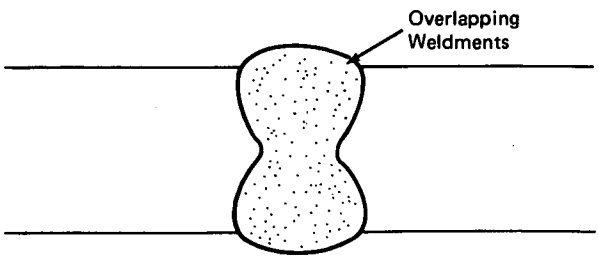

Figure 2. Full Penetration Weldment With no Defects

(continued overleaf)

suitable with 2014 and 2219 aluminum alloys because they also contain copper in small quantities as alloying material. The presence of this extra copper in the full-penetration weldment (see Figure 2) has no significant effect on the mechanical properties or chemical composition of welded joints.

Copper may be applied by spraying, coating, or deposition. Its thickness on the faying surfaces must be uniform in the range of 0.2 to 0.5 mil (0.005 to 0.013 mm) thick. In addition, the coating must be free from spalling and blistering and must contain no porosity.

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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