NASA TECH BRIEF

Langley Research Center

Nondestructive Testing for Braze Voids in Thin Panels by Use of Special Coatings

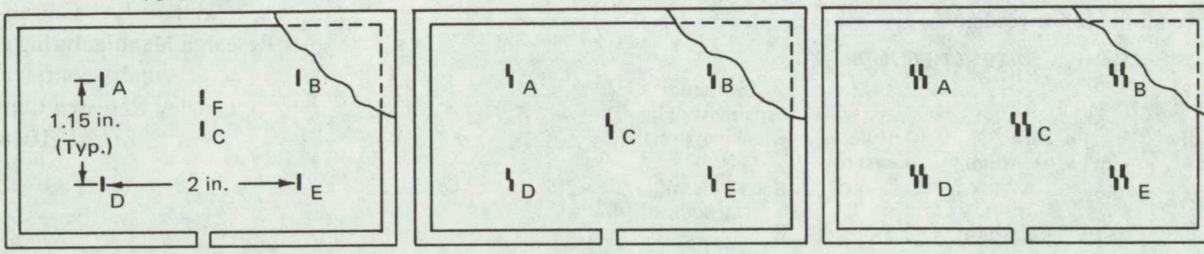

Figure 1.

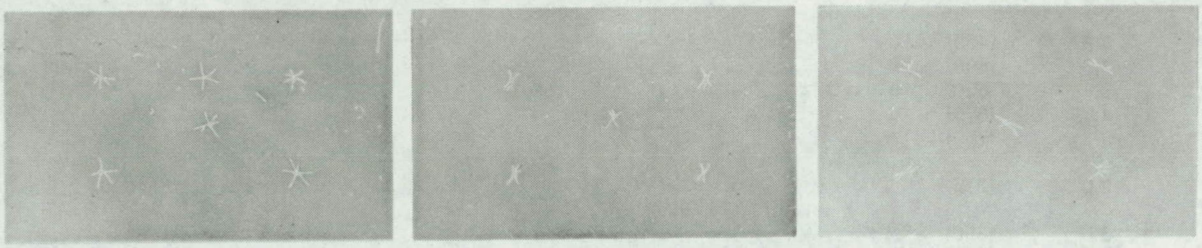

Figure 2.

The problem:

The laminae of single-sandwich panel structures used for pressure containment are bonded together by brazing. In the brazing process, voids may be left between the laminae, and when the panel is subsequently subjected to differential pressure, these voids become points of maximum stress.

The solution:

A commercially available coating (Stresscoat or its equivalent) has demonstrated substantial advantages in the nondestructive detection of braze voids in single-panel structures. This coating applied directly to the panel will indicate the areas of high stress over braze voids by simple inspection. The method is more direct than the ultrasonic, radiographic, or infrared void detection techniques which require an additional step of interpretation of the recorded data.

How it's done:

The panels are first cleaned with toluene, spray painted with silver paint (Krylon or its equivalent) to gage stress coating thickness, and then painted with the stress coating. The curing period for the coating ranges from 12 to 24 hours for the coating thickness of 0.13 to 0.25 mm (5 to 10 mil). Maximum sensitivity is obtained after about 24 hours of curing.

The stress coating is calibrated by placing a weight on a coated cantilever beam. The minimum uniaxial cracking stress is proportional to the distance from the load application to the first crack observed in the coating. The biaxial stress characteristic of the voided areas is only in error a maximum of 15 percent from the minimum uniaxial calibration stress.

The panels are hydrostatically pressurized in any convenient increments until visual cracks appear in the coating above the braze fin voids. (The panels are not

(continued overleaf)

pressurized while the surface is being examined for cracks.) A flashlight, with the beam directed parallel to the surface, aids the visual observation of the surface for stress cracks.

To evaluate this technique, three 6.35-by-10.16 cm (2.5-by-4 in) plate-fin panels were fabricated with known braze voids (Figure 1). The panels were fabricated from 0.38 mm (0.015 in) Hastelloy X plates with 1.91-by-2.54-by-0.15 mm (20R-0.075-0.100-0.006 in) Hastelloy X fins. After being cleaned and spray painted, the panels were painted with Stresscoat ST-75. The 75 designates the ambient test temperature, which in these tests was 21°C (70°F). To obtain greater sensitivity, hydrostatic pressure was applied in 446 x 10^3 N/m^2 (50 psig) increments until cracks appeared above all of the fin braze voids. These cracks appeared at the pressure and location given in the table of test results. Figure 2 shows the three panels with the stress coating cracked above all the braze voids.

TEST RESULTS

Panel No.	Pressure N/m^2 x 10^6	(psig)	Void Location	Stresscoat Sensitivity (Min. Cracking Stress) N/m^2
1	5.6	(800)	B and C	8 x 10^7 N/m^2 (11,600 psi)
	8.72	(1250)	E and F*	
	10.4	(1500)	A and E	
	11.8	(1700)	D	
2	3.2	(450)	C	
	3.6	(500)	E	
	3.9	(550)	B and D	
	4.8	(675)	C	
	5.3	(750)	A	
3	2.0	(275)	C	9.45 x 10^7 N/m^2 (13,700 psi)
	2.5	(350)	A	
	2.9	(400)	E	
	3.2	(450)	D	
	4.2	(600)	B	

The braze void locations shown are as noted in Figure 1.
*Void F is unique to panel #1.

Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Reference: B72-10374

Patent status:

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

Patent Counsel
Langley Research Center
Mail Code: 456
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Source: J. C. Gibson of
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