

NDT OF SPECIAL HONEYCOMB STRUCTURES BY USING MICROWAVES

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Abstract

For lightweight design of aerospace parts sometimes honeycomb structures are used, which are filled with epoxy resin and hollow glass microspheres. The necessary testing for pores can be done by X-ray techniques. This is of high effort and therefore expensive. Microwave non-destructive testing seems to be a candidate for a less expensive NDT method. In order to prove this, tests were performed at a model part.

This concerns a honeycomb plate with transversal dimensions of 250 mm x 80 mm and a thickness of 36 mm. The cell width is 4.8 mm, the hollow glass microspheres have an outer diameter of 80 μ m to 100 μ m. Besides of clusters of "natural" defects there are "artificial" blind holes in the plate with diameters ranging from 1.0 mm to 2.0 mm and residual wall thicknesses from 14 to 24 mm. Preliminary tests were performed with various waveguide type and lens type antennas between 24 GHz and 40 GHz. This report describes reflection tests with a lens type antenna and transmission tests with waveguide antennas.

In the reflection tests at 35 GHz with a lens antenna the sample was scanned in meandering pattern from the completely filled side. Modulus and phase were used to evaluate the data. To optimize the representation of the indication the projection phase was varied. In this way all known and additional defects were recognized. It is shown, how in cases of doubt it may be helpful to inspect more closely the local surrounding of the indication in the complex plane of the reflection coefficient.

The transmission tests were performed at 24 GHz with two open ended rectangular waveguides as receive and transmit antennas. These tests also gave indications of most of the defects. However, the clearness was somewhat reduced by interference signals.

As a conclusion: The suitability of microwave testing is confirmed for the described type of honeycomb structure.





















