

1.9.29. A1550 INTROVISOR APPLICATION FOR INSPECTION OF LAMINATED PLASTICS

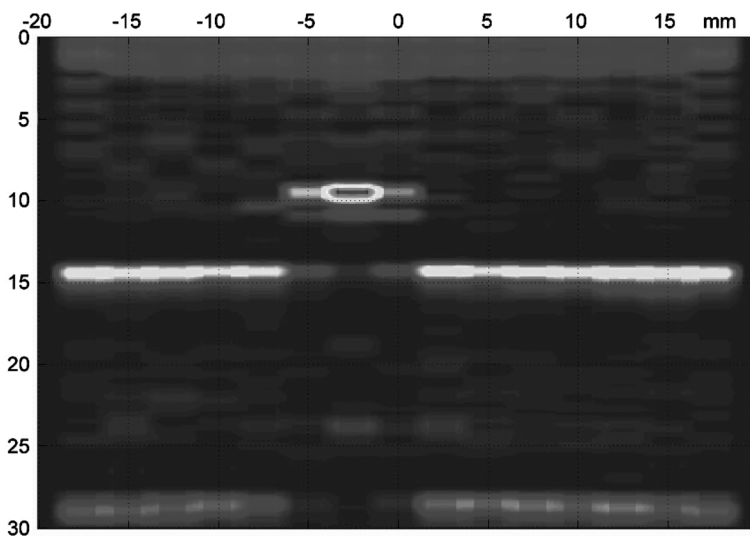
Samokrutov A.A., Shevaldykin V.G.,
Acoustic Control Systems Ltd., Moscow, Russia

Polymer and all-carbon composite materials are widely used in aerospace industry. The main advantage of the materials is that at higher strength the weight of the material is much lighter in comparison to the metals.

Usually for inspection of these materials the impedance flaw detectors and pulse-echo flaw detectors are used. The inspection is made with direct-beam contact ultrasonic transducers in the frequency range of 1 to 5 MHz.

Due to the significant sizes of parts and objects from composites the effectiveness of ultrasonic inspection is quite low, at that the time for inspection and analysis of results is very long. It is possible to reduce the time and increase the efficiency of inspection using the ultrasonic tomograph A1550 IntroVisor*, working on Sampling Focus Array technique (SFA) [1, 2].

The tomograph A1550 IntroVisor is developed and applicable for flaw detection of objects from metals. The polymer composites differ from metals by high anisotropy of elastic characteristics, by laminated structure and quite high attenuation of ultrasound. Thus, for ex. when the average ultrasound velocity of longitudinal waves in the direction across the layers is 3000 m/sec, the velocity in the direction along the layers can achieve the value of 6500 m/sec and even higher. The thickness of the material is usually in the range from 1 to 40 mm.



* <http://acsys.ru>.

In regard to the significant anisotropic characteristics and laminated structure of polymer composites the special algorithms for tomographic imaging reconstruction were specially developed and the inspection methodics and analysis of received images were modified. As a result the higher sensitivity to the defects in a wide range of depths from 2 mm was achieved. The experiments confirmed the efficiency and informative results of polymer composites inspection using A1550 IntroVisor tomograph.

The example below shows the cross section of an object from all-carbon composite 14 mm thick with flat-bottomed drilling 5 mm in diameter with the bottom at the depth of 9 mm.

References:

1. **Alekhin S.G., Bishko A.V., Zhukov A.V., Sokolov N.J., Samokrutov A.A., Shevaldykin V.G.** Use of phased arrays in combination with virtual dynamic focusing for ultrasonic tomographic imaging of metals / Testing. Diagnostics. – 2008. – № 7. – P. 42 – 44.
2. **Samokrutov A.A., Shevaldykin V.G.** Ultrasonic Tomography of Metals Using the Sampling Focus Method. 10th ECNDT, Moscow. June 7 – 11, 2010. Abstracts, Part 1. – M.: Publishing house Spektr, 2010.