

# **Application of ultrasonic diffraction methods for resistance spot welding inspection**

**Nikolay Aleshin<sup>1</sup>, Mikhail Grigorev<sup>1</sup>, Nikita Shchipakov<sup>1</sup>, Denis Kozlov<sup>1</sup>, Nikolay Krysko<sup>2</sup>, Alexey Popovich<sup>1</sup>**

<sup>1</sup>Non-destructive testing, «Welding and Testing» Of MSTU n. a. Bauman, Russia, <sup>1</sup>Non-destructive testing, «Welding and Testing» Of MSTU n. a. Bauman, Russia

Resistance spot welding was developed about 120 years ago and is widely used in the automobile production and aerospace industry, because it is fast, cheap and reliable method of sheet plate junction. This welding method is prone to flaw formation inside the weld nugget, such as shrinkage cavity, lack of fusion, crack and oxide film. Aluminum alloys have a high-heat oxide film and, therefore, weld spots have a high tendency to incomplete dissolution of oxide films inside the weld nugget. The presence of oxide films abruptly reduce the ductility of joints, therefore, they are dangerous and hard detectable flaws. This study describes the use of the Time-of-Flight Diffraction method for assessing the weld nugget diameter and the diffraction Delta method for detection and type determination of flaws inside the weld nugget. During the Delta method, flaw type is determined by the amplitude of the diffracted signal and allows you to divide the flaws into volumetric, planar defects with absence of metallic bond and with partial metallic bond (oxide films). The results of detectability comparison of the ultrasonic pulse-echo method in various areas of the weld spot, radiographic and ultrasonic diffraction Delta methods are also presented in this study. As a result, a transducer model for inspection of aluminum joints obtained by resistance spot welding based on ultrasonic diffraction methods is proposed. The use of this transducer will significantly increase the reliability of the resistance spot welding joints inspection.