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ADVANCED EDDY CURRENT METHODS FOR EVALUATING AVIATION COMPONENTS

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The presentation provides guidelines for conducting eddy current non-destructive testing on components made of Al-Mg-Si alloy, a popular material in the aerospace industry due to its high mechanical properties and good corrosion resistance. Several potential defects may exist in such components, including internal voids or blowholes, cracks, corrosion, and inhomogeneities in the material's structure. Internal voids can occur during manufacturing, reducing mechanical strength and potentially leading to failure. Cracks may form due to stress or mechanical influences and can propagate, causing component failure. Corrosion may develop on the surface when exposed to aggressive environments or high humidity, weakening the components. Inhomogeneities arising during manufacturing or thermal treatments can affect mechanical properties and lead to failures [1].

To perform eddy current non-destructive testing on Al-Mg-Si alloy components, specialized equipment is required. Our experience has shown that the Olympus Omniscan MX Instrument, a portable eddy current device known for its high precision and reliability, and the Sab-064-030-032 Matrix Probe, a differential-type probe with excellent resolution and high sensitivity to various defects, are highly effective [2, 3]. Calibration specimens are used to ensure compliance with standard ISO 15549:2019, and a computer with software is necessary for data processing and analysis. Successful testing requires modern, reliable equipment meeting the standard's requirements [4].

Sample preparation is crucial for accurate and reliable results. The surface of the sample must be clean and free from contaminants such as dirt, grease, and paint, which could hinder defect detection. Solvents, degreasers, and other cleaning agents are used for surface cleaning.

The setup of the eddy current instrument involves adjusting the frequency, amplitude, and sensitivity. Frequency, affecting the depth of eddy current penetration, should be set at 20 kHz based on the object's preliminary inspection. Amplitude, determining the intensity of induced eddy currents, should be set at 5V. Sensitivity, determining the device's ability to detect small changes in electrical resistance, should be set at 80dB. After setting these parameters, a calibration check is performed, and the parameters are recorded for further data processing.

Inspection begins by ensuring the Olympus Omniscan MX eddy current instrument and Sab-064-030-032 probe are properly set up. The probe is scanned smoothly across the sample's surface, observing indications on the instrument's screen. Signals indicating defects, such as cracks, inclusions, and corrosion, are noted for their intensity, shape, and location.

Evaluation criteria based on technical requirements, customer specifications, or internal norms are used to assess detected defects. These criteria determine the permissible size, type, and location of defects. The maximum permissible sizes and allowable quantities of defects per specific section of the component are established for defects like cracks, inclusions, and bubbles [5].

After completing the inspection, the operator gathers all data and results, including defect details and the condition of defect-free areas [6]. The results are presented in various forms, such as records, graphs, and photographs. A report may be prepared, displaying all results, identified defects, and their characteristics.

Based on the inspection results, a qualified specialist assesses the component's suitability for use, drawing conclusions about defect presence, type, size, and impact on quality and safety. The conclusion may be a simple textual description, a defect report, or a document with inspection results and recommendations for further processing or utilization. All data and inspection results must be documented. The operator records the results in inspection cards, logs, databases, or other documentation forms used in the company. Documentation preservation allows for revisiting results, performing analysis, and ensuring accountability and quality control of the production process.

In conclusion, eddy current non-destructive testing is an effective method for identifying defects in alloy components. Proper equipment, careful sample preparation, and precise instrument setup are essential for accurate results. Thorough documentation and evaluation ensure the reliability and safety of the inspected components.

References

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