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REDUCING THE LEVEL OF INTERFERENCE CONSIDERING THE MORPHOLOGICAL CHARACTERISTICS OF OBJECTS IN THERMAL NONDESTRUCTIVE TESTING

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ABSTRACT

The interferences characteristic of thermal non-destructive testing that reduces the reliability of the obtained results are described. A methodology for their reduction is proposed, consisting of two interdependent stages. The first stage consists in calculating and analysing the nature and level of the expected signal according to the developed thermophysical model against the background of the experimentally obtained level of interference. According to the results of the analysis of the calculations based on the thermophysical model for the selected samples, the most influential interference was the heterogeneity of the emissivity of the sample surface. The second stage of data processing is devoted to reducing this interference. The second stage consists of processing the thermograms of temperature fields and includes morphological analysis of the surface condition, filtering, and reduction of characteristic interference. It is divided into four practical procedures. Analysis of the visual image and obtaining a map of zones with the different emissivity of the sample surface, analysis of the thermogram with an assessment of the level of discreteness of the thermogram and the position of the reference points on the image, smoothing of the thermographic image and selection of zones with the different emissivity of the surface of the object under control on the thermogram, followed by noise filtering. Since the results of thermal control are strongly influenced by the shape of the object, the capabilities and effectiveness of the proposed methodology are illustrated on a cylindrical object (Figure).

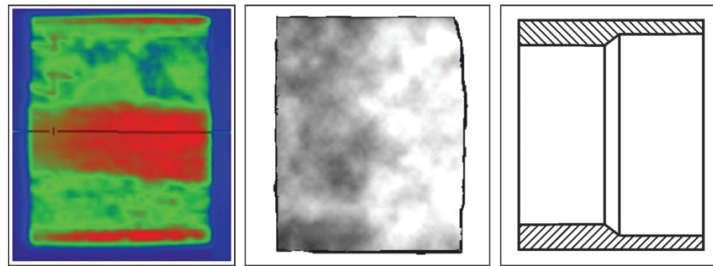


Figure - Thermogram of a sample fragment, its reconstructed temperature field and longitudinal section

The experiment confirmed the validity and correctness of the theoretical statements and allowed us to determine the internal structure of the object under study (different wall thicknesses) and reduce the level of structural interference by 3.6 °C. The research shows that the processing of experimental data, which was carried out taking into account the specifics of the thermal and structural characteristics of the objects under control, gives a significant positive result and is an important step towards automating thermal non-destructive testing procedures on the way to implementation in current production.

Keywords: thermal nondestructive testing, structural interference, thermophysical model, image processing, morphological analysis.