

1.1.8. CONTROL OF WELDED JOINTS HEAT TREATMENT QUALITY BY STRAY MAGNETIC FIELDS

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Authors have developed method to control the quality of heat treatment (HT) of welded joints (WJ's) by stray magnetic fields. In general, essence of the developed method consists in determination of the non-uniformity of stray magnetic field in welded joint prior and after heat treatment reflecting structural, physical and mechanical irregularity of metals, as well as non-homogeneity of mechanical stresses in welded joint prior and after heat treatment, their comparison and evaluation of quality of the performed heat treatment of welded joint by the degree of reduction of the non-uniformity of WJ stray magnetic field after HT in relation to respective non-uniformity prior HT. The lesser is value of the WJ non-uniformity of stray magnetic field after HT as compared with respective non-uniformity prior HT, the higher is quality of heat treatment of the weld seam and its heat-affected zones. Figure below shows three magnetograms for each one of the tested welded joints – weld seam and weld-affected zones prior (upper part of figure) and after heat treatment.

It is clear from figure that non-uniformity of every magnetogram and between them following HT is reduced significantly. I.e., they become smoother and closer each other. Under data of –practical application of the method developed by authors, its sensitivity exceeds in many times currently existed methods resolving the same problem. Besides, existed methods (for example: [1], [2] and others) suffer also from the series of other disadvantages like, in particular, considerable labor content and complexity in implementation, low trustworthiness of testing results, low resolution, limited number (most often, one) of testing parameters, lack of testing results demonstrativeness, etc.

Developed method can be adapted comparatively easy to available possibilities of the non-destructive testing services with users. Thus, any available instrument for measuring physical quantity values (one and/or more) of stray magnetic field can be used for implementation of this method: magnetic field intensity (A/m), magnetic induction (μT), magnetic field gradient (A/m/mm), gradient of magnetic field induction ($\mu\text{T/mm}$) and others. Moreover, these measurements can be carried out in both manual and automatic modes.

Paper also reflects various options for evaluation of the magnetic field non-uniformity during control of the quality of WJ heat treatment.