

1.1.23. SPECIFIC VAMGENTIC ENERGY OF MATERIAL AS PARAMETER FOR SELECTION OF METHOD OF MAGNETIC PARTICLE TESTING

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In magnetic particle testing, various methods and technologies are used. Depending on magnetic properties of a material, testing method based on the residual magnetization and method of impressed magnetic field is applied.

Testing on the basis of residual magnetization consists on sequential execution of following technological operations:

- preparation of article for testing;
- magnetization of article;
- application of magnetic particles (suspension or magnetic powder) on the article surface;
- inspection of article;
- decoding of indicative pattern (agglomerations of magnetic powder) and determination of article compliance with technical specifications or acceptance standards;
- demagnetization and control of demagnetization;
- removal of magnetic powder residues from article.

Testing under method of impressed magnetic field consists in that technological operations like magnetization, application of magnetic indicative composition on the article surface, inspection of partial inspection of article are performed simultaneously.

Testing based on the residual magnetization has the number of significant advantages:

- possibility to locate tested article in any convenient position for good surface illumination and inspection with naked eye using hand magnifier, microscope and other optical devices;
- possibility to apply suspension by both coating and submersion of several articles simultaneously into the bath with suspension;
- simplicity of decoding of powder depositions (powder sediments in lower degree in the places of grooves, cold hardening and rough treatment of surface);
- lower possibility of article overheating in the places of article contact with discs of clamping device of flaw detector due to short-term passing of electric current;
- higher testing output.

Therefore, testing method based on the residual magnetization is more preferable. The main pre-condition of its application is ability of material to maintain high enough value of residual magnetization. Currently, such property of material is evaluated by the value of *coercitive force* H_c . It is possible to carry out testing under the method of residual magnetization when $H_c \gg 9.5$ A/sm. However, this parameter appears to be not sufficient so far, because there are steel grades existed with $H_c < 9.5$ A/sm, while articles of these steels can be tested efficiently under method of residual magnetization. There are materials with higher coercitive force, while articles of these materials can be tested only under method of impresses field, because small defects in them are not detected under the method of residual magnetization.

In connection with the lack of objectivity of the coercitive force value, the method of impressed field is preferred at enterprises when the testing method is selected, though it results in appreciation of testing and to deterioration of testing quality in some cases.

Insufficiency of H_c parameter is explained by the fact that it does not take into account the value of magnetic induction in a material. More complete parameter is required, which would consider both coercitive force and the magnetic induction value. Studies have shown that specific magnetic energy in a material and defect cavity can be accepted as such a parameter.