1.3.89. COMBINED ACOUSTO-MAGNETIC METHODS OF NON-DESTRUCTIVE TESTING AS A NEW QUALITY OF FLAW DETECTION AND EXPANSION OF THE NDT APPLICATION FIELD

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Herein are examined the issues of technical realization and practical application of acoustic-magnetic method of NDT. This method is based on the registration of electromagnetic fields of the flaws in magnetized materials, which arise at propagation of ultrasonic waves in these materials.

A significant property of the acoustic-magnetic method for applied defectoscopy is the ability to realize the control without physical contact and the capability to detect discontinuities at the background from the structured and magnetic heterogeneity of the material. In addition, the acoustic-magnetic method is able to detect both surface flaws and flaws disposed on depth.

Specificity of mechanism of induction by ultrasonic wave of electro-magnetic fields at interaction with the magnetized flaws allows detecting flaws the equivalent sizes of which are 100 times less than the length of the probing ultrasonic wave. So, the 0,05 mm depth cracks are detected at acoustic-magnetic method using the 400 kHz Rayleigh wave as a probing waves.

The acoustic-magnetic testing is performed in the following way.

The probing ultrasonic waves are generated in the object under control. The magnetic field is added on the tested object. The probing wave is propagated in the object under control. The electromagnetic waves are generated at interaction of these ultrasonic waves with the flaw located on the path of their propagation. These electromagnetic waves are registered by receivers.

The special improved Electro-Magnetic-Acoustic transducers and Acoustic-Magnetic transducers have been devised for the technical realization of acoustic-magnetic NDT. These special improved transducers allow performing flaw detection at air or dielectric gap (between the transducer and object) up to 6mm. Invented transducers provide a sensitivity that is equal to "A"-class sensitivity of the magnetic powder technique.

The applying of low-frequency (200…400 kHz) Rayleigh wave as a probing wave provides high sensitivity acoustic-magnetic testing of the items with a very rough surface (for example, such as continuously casted products with typical cast rough surface or metalware with very corroded surface).

The flaw detection through the protective coating of the surface is also possible. It is also possible through the coating or layer of dirtiness with thickness up to 6mm and up to 15 mm in some cases.

These properties of the acoustic-magnetic defectoscopy allow performing highly productive and reliable control of continuously casting metal products without preparation of their surfaces.

Also, acoustic-magnetic flaw detection is effective for detecting of the stress-corrosive cracks in the gas main-pipes without removing of pipe coating.

Due to its metrological abilities, the acoustic-magnetic defectoscopy is able to replace the magnetic powder testing, automate it and make it independent from the human factor influence in most cases.

The handheld defectoscope “ЭМАД 2-01” and its options for defectoscopy of continuously casting products and main-pipes has been designed on the basis of acoustic-magnetic method and produced in serial production.

The multichannel automatized industrial acoustic-magnetic defectoscopes of metal pipes and rolled metal are also at present under designing (main conditions of applying: test speed is up to 20 m/s and temperature of the products under control is up to +700ºC).

Thus, the acoustic-magnetic method makes now by possible the NDT of objects and of products which earlier were considered as unapproachable for testing.

The acoustic-magnetic method has the best ratio of productivity, sensitivity and cost price among other methods of non-destructive control, especially in complicated technological conditions.