DETERMINATION OF CHARACTERISTIC PARAMETERS OF SOLID-STATE MATERIALS WITH THE HELP OF INFORMATION TECHNOLOGIES

Kustov A. I., Merkulov S. A., Pletneva E. A[1].

Voronezh State Pedagogical University, physical-mathematics department, chair of applied physics
[1]Voronezh Institute of Low and Economy, economy department, chair of applied information science
Russia, 394000, Voronezh, Lenin street, 86, phone (473-2)-379-973
[1]Russia, 394042, Voronezh, Lenin avenue, 119, phone (473-2)-601-564
akvor@yandex.ru

At present the problem of nondestructive express control of physic-mechanical properties of materials in condenses state is one of the most important scientific problems. In this paper the results of experimental work of investigation of physic-mechanical properties materials with the help of scanning acoustic microscope (SAM) [1] are given. The essence of the subjected methods is first inlayer visualization of subsurface structures of the objects under investigation and second in the definition of velocity values of acoustic waves and calculate the elasticity constant of solid material. The state of the material when it is close to the loss of stability is called limit. It is necessary to reveal such states at the possibly initial stages. First the local structure changes inner stress, physical-mechanical parameters (e.g. the velocity of acoustic waves (AW)) can be used as the limit criteria.

One of the important parameter of solid state sample is the grain dimension (d_3). The dependences of conventional fluid point (σ_{02}) from dimension d_3 in one of low carbon steel type are present in fig.1. The results were obtained with standard definition. As follow from that diagram, linear dependence σ_{02} from grain dimension observes in 10-150 μm interval. Received dependences σ_{02} from d_3 are in good accordance with low Hall-Peach: $\sigma_{02} = \sigma_0 + k\,d_3^{-1/2}$, were k and σ_0 – the constant for that material.
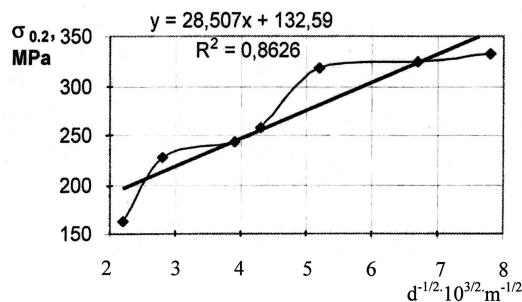

Fig.1. The strength properties dependence $\sigma_{0.2}$ from grain dimension (d_3) by 14ХГС steel
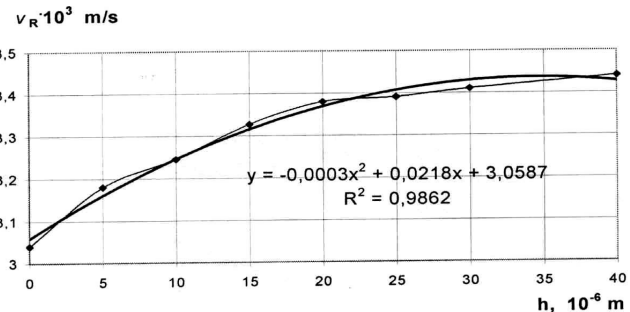

Fig.2. The dependence of SAW velocity in steel (08Х18Н10Т) on the depth penetration

The results of the experiments illustrating the possibility to define the thickness of the modified layer were presented before. The difference between the initial and modified material according to these characteristics can reach 5–20%. The results of modeling experimental for nitrogen steel are presented in fig. 2.

Acoustic microscopy methods have prospects for studying the materials on condensed state and their properties. These processes are more effectively, if information technologies were applied.

References

2. Kustov A.I., Migel I.A. (2007) Investigation of the physical properties of materials for fuel elements and work up of limit state criteria…with acoustic microscope defectoscopy methods.//Hydrogen materials science, Science Series, A: Chemistry and Biology, p.451-458.