

The determination of the physical parameters of the subsurface layers of solid materials using AMD-methods

V. Zelenev¹, A. Kustov¹, I. Migel²

¹ Voronezh, Russia, Voronezh State Pedagogical University

² Voronezh, Russia, Military Educational and Scientific Center of the Air Force Academy named after Professor N. E Zhukovsky and Y.A. Gagarin

akvor@yandex.ru

Currently one of the most urgent material problems is the problem of studying the structure and properties of solid materials non-destructive way, the definition of the boundaries of their applicability. In the end, the structure determines the condition of the material actually given by a superposition of the physical parameters of the selected volume. Changing these values allows judging the state of the surface layers of solid materials. Effective methods control the state of these layers are AMD-methods [1,2].

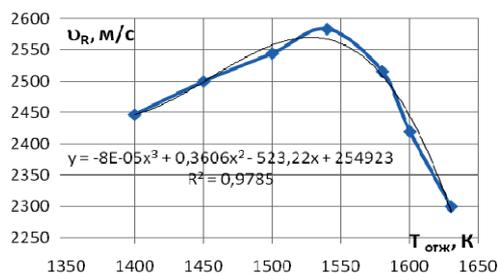
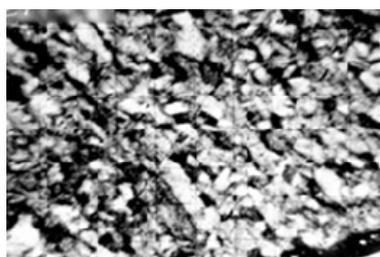


Fig. 1. a) Acoustic image of the grain structure (steel, scale 100-150 μm , $Z = -14 \mu\text{m}$); b) Dependence v_R from T_{ann} - piezo-ceramic (PZT-22) received AMD-method.

The essence of the work was to develop methods for studying the state of the materials and in the assessment of the level of exposure of diffusion processes. Objects of study – ceramic materials and steels of various types.

In the mode of acoustic imaging has got the image of the grain structure of the steel (Fig.1a) and grain size was calculated strength characteristics. After the diffusion treatment was varied grain structure, and hence the values of the parameters of the material. To ensure the objectivity and reliability of the measurements experiments were carried out on model objects with known characteristics-sticks (single crystals, glass, pure metals). Developed and applied a method of calculating parameters of the samples by the values of speed and attenuation coefficients of surface acoustic waves (saw) [3]. It is possible to obtain study materials for the correlation of velocities of surfactants on the parameters of the effect on the material (temperature, time). In Fig.1b shows one such dependency of the piezo-ceramics.

The obtained results demonstrate the effectiveness of the use of AMD-methods for the determination of the physical parameters of the surface layers of solid materials and ensure their accuracy.

References

1. Kustov A. I., Miguel, I. A. Identification and characterization of defects in solid materials using acoustic waves // *Materials Science.*, 2011., No. 8., S. 31-42.
2. Miguel I. A., Kustov A. I. The study of metal layers and polymer composites by using acoustic waves // *Fundamental problems of modern materials science.*, volume 12, No. 2., 2015. p. 241 -247.
3. Kustov A.I., Miguel I. A. Analysis of the behavior of defect structures that occur in solid materials with AMD-methods // *Fundamental problems of modern materials science.*, vol.13, No. 4, 2016. p. 490 - 496.