1.12.28. THE INFLUENSE OF INTERBAL STRESS AND STRUCTURAL STATE IN WIRES ON THE BASIC CHARACTERISTICS OF POHGAMMER'S WAVES

Muraviev V.V., Korobeynikova O., Platunov A.,
Izhevsk State Technical University (IzhGTU), Izhevsk, Russia

Technological process of manufacture of a metal wire influences on resistance to deformation and destruction of a material essentially in conditions of complex deformations. Therefore researches of the structural and stress deformed state of a metal wire are one of actual problems, both in modern metallurgical science, and in many industries.

Acoustic method with application of Pohgammer's rod-wave in the field of the minimal dispersion of velocity (small multiplication fd, f – frequency, d – diameter of object) to use at researches of the structural and is intense-deformed condition of a wire is expedient.

Phase and group velocity of a longitudinal wave of zero order C_{S_0} aspire to the general limit at $fd \to 0$ – to rod-velocity of wave. They are defined by expression: $C_0 = \sqrt{E/\rho}$ (E – Yung module, r – density of environment).

Low attenuation of a rod-wave and absence of a divergence does sounding base to increase repeatedly, and, hence, to raise accuracy of a research of structure by acoustic method essentially, to provide sensitivity uniform to pressure on section of a wire, in difference from volumetric waves.

Experimental installation for researches of influence of structure and deformations of a wire on parameters of a rod-wave has been developed. It provides high tool accuracy of measurement of velocity of distribution of waves of ~0,5 km/s or 0,01% at sounding base 250 mm. Quality of acoustic contact defines sufficiently accuracy and reproducibility of researching of structure of acoustic method. The way of input and reception of acoustic waves by means of contactless electromagnetic-acoustic (EMA) method allows discharged of its influence.

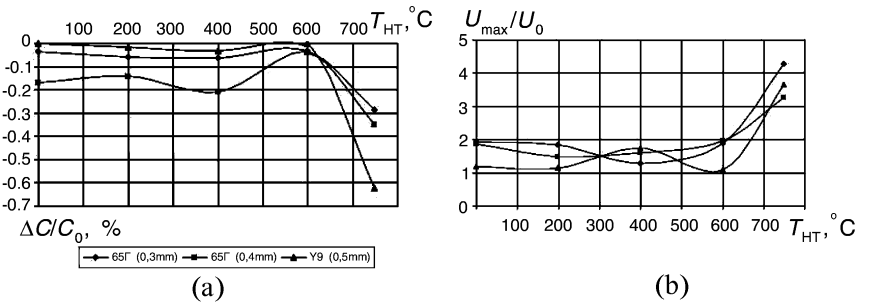
Experimental researches on influence of structure and the is stress deformed state of a wire on the basic laws of distribution of Pohgammer's rod wave for a wire from steel 65G (0,3 mm and 0,4 mm in diameter), U9A (0,5 mm in diameter) have been executed. The wire has been investigated in a condition of delivery, and after various temperatures of heat treatment, after full heat treatment during increase and reduction of a stress (up to 1000 MPa) including.

Values of acoustoelastic factors of velocity β_{S_0} and of amplitude β_U have been calculated. These factors show effects of reduction of velocity and increase of amplitude of a rod wave at change of tensile stress. Influence of heat treatment on the basic characteristics of Pohgammer's rod waves is shown in fig. 1.

The researches of wires of various diameters from steel 65G and U9A have shown presence of following unequivocal dependences: velocity of a rod wave is decrease, if external tensile stress is increase; velocity of a rod-wave and acoustoelastic factor on velocity is increase, if applied pressure is decrease; amplitude of a rod wave and acoustoelastic factor on amplitude is increase, if external tensile stress is increase, and if applied pressure is decrease.

Table 1

Heat treatment, °C	0	200	400	600	750
Acoustoelastic factors β_{S_0}, TPa^{-1}					
65G (∅0,4 mm)	–270	–230	–330	–65	–560
U9A (∅0,5 mm)	–70	–100	–130	–130	–1200
Velocity of a rod-wave in not tensile stress state C_0, m/s					
65G (∅0,4 mm)	5001	5064	5177	5070	5146
U9A (∅0,5 mm)	5121	5148	5144	5102	5128
Acoustoelastic factors β_U, GPa^{-1}					
65G (∅0,4 mm)	2,99	2,36	2,57	3,13	5,25
U9A (∅0,5 mm)	1,09	1,03	1,59	0,99	3,31



(a) (b)

Fig. 1. Relative change of velocity (a) and relative growth of amplitude (b) a rod-wave from temperature heat treatment T_{HT} for samples of wire different steel and diameters

The effect of acoustoelastic is shown in steel U9A most brightly. The received values of acoustoelastic-factors for rod-waves surpass known values for volumetric and surface-waves essentially.

Experimentally observable results are confirmed by researches of other authors in the field of researches of the structure by magnetic, and electromagnetic-acoustic transformations indirectly.