Research of influence die geometry on fatigue strength and parameters of drawing process of EN AW-1370 wires

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ABSTRACT

The traditional overhead conductors are made from a high strength steel core and several layers of aluminum wires. Operating conditions, and the work under variable stress derived from von Karman vortices leads to fatigue cracking of the outer layer of wires, first of the outer layer, and then the inner layers. The dynamic component of tension, dependent on the static tension of the wire, its geometric construction and rigidity (the number and diameter of the wires, the coil angle), lead to fatigue destruction of the wires. The consequence of this is the gradual degradation of the conductor as a whole, which is a decrease in the electrically active cross-section, and as a result of overheating, also in its mechanical properties. The ultimate effect is breaking of the conductor and a fault of the power line. For several years now, the currently binding normalization in the design of high voltage overhead power lines imposes a requirement of a 50-year failure-free exploitation The subject of the article concerns the influence of die geometry on fatigue strength on aluminium wires in electrical power engineering. The article describes the importance of operational problems with emphasis on fatigue resistance, the methodology research, job description and how to analyse the results of fatigue strength. Based on the results of research and analysis formulated proposals for diversification of fatigue wire EN AW 1370 (references 1-5)

THE AIM OF THE WORK

The aim of work is to check the influence of die geoemtry on fatigue strength and drawing proces parameters like temperature and drawing stress of EN AW-1370 wires. In geometry will be change: die reduction angle (2α), length of the calibration belt (h).

RESEARCH PROGRAM

The procedure for preparing samples for fatigue testing included preparing simple samples, approx. 400 mm in length, and then mounting them in a rotary flexural testing stand for testing fatigue processes. Figure 1 shows a scheme of the stand and Fig.2 - a photo of the stand. The samples were subjected to fatigue tests at a tension in the range of 30-135 [MPa]. The actual value of stresses impacting the fatigue tested wire was determined by a strain gauge. The rotary bending stand for testing fatigue processes is based on the known principle of operation of this type of equipment. It involves the generation of time-varying tension on the sample (in this case a wire), by deflection, and then setting it in an axial rotational motion (3000 r.p.m.). In the presented position, stress is transmitted through symmetrical bending of the sample by a known deflection (0 ÷ 230 mm, with the possibility of change at every 10 mm).

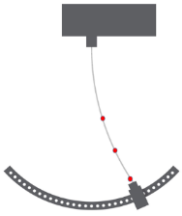

Fig.1 Scheme of fatigue stand

Fig.1 Photo of fatigue stand

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Key words: overhead conductors, fatigue strength, drawing process, die angle, aluminium wires

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