

1.14.26. MAGNETIC METHODS OF TESTING ELASTIC-PLASTIC STRAIN IN STRUCTURAL POWDER STEELS

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Impact of deformation by uniaxial tension on magnetic characteristics of structural powder steels of 50N2M and ZhGr types was studied.

Specimens of 50N2M steel with average carbon content of 0.35 wt.% had different porosity (4, 12 and 17%), while specimens of ZhGr steel had different both carbon content (0.03; 0.45 and 0.95 wt.%) and initial porosity (8, 12 and 18%). Besides, in order to decrease the residual porosity, specimens of ZhGr steel were subjected to cold rolling with different degree of reduction. Then, specimens were elongated with simultaneous measurement of their magnetic characteristics in closed magnetic circuit under permeameter ν diagram in fields of up to 60 kA/m.

With increasing of tension stresses, coercive force of 50N2M steel decreases initially, while then starts to grow. Decreasing degree of coercive force is proportional to porosity of specimens. Possibility to select magnetization field, when coercive force of the particular cycle of magnetic hysteresis depends weakly on porosity, is demonstrated. An assumption that applied stress, when coercive force minimum of such particular cycle is observed, corresponds with internal stresses of material is expressed.

With growth of the degree of preliminary deformation of ZhGr steel by rolling in the result of residual porosity reduction and material cold-work hardening, temporary resistance and yield point increases with reduction of plasticity in several times. During deformation by more than 20% rolling, decreasing in values of strength characteristics due to the high damage degree of material is observed with part of specimens.

With growth of deformation degree, the coercive force value in the elastic field decreases, while increasing trend becomes apparent with approaching of stage of the developed plastic deformation.

Non-monotonous dependence of coercive force of steel of both types on applied stresses can be explained by the influence of magnetoelastic effect. Deformational behavior of residual induction and maximal magnetic permeability of steel of both types reflects specularly the deformational behavior of coercive force.

Monotonous dependence of coercive force on the degree of tension deformation in elastic field indicates the principal possibility of elaboration of coercive force measurement method for evaluation of elastic deformations during operation of articles of powder steels of 50N2M and ZhGr types.

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