RESISTANCE OF RESIDUAL STRESSES INDUCED BY ROLLERS DURING CYCLIC AND REPEATED STATIC BENDING

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The problem of increasing structural strength is becoming increasingly important due to the growing load and speed of modern machines. Among the progressive processes aimed at improving the reliability and durability of such products, a special place is occupied by surface plastic deformation (SPD) hardening.

Studying the physical, mechanical, and structural characteristics, especially residual macrostresses, when choosing methods and modes of SPD, as well as the patterns of their change under conditions close to operational ones, will allow us to choose not only the optimal methods of strengthening parts, but also to develop scientifically sound standards for such a choice. Management of residual stresses will make it possible to realize the potential capabilities of high-strength steels to a greater extent. This paper is devoted to solving these topical issues.

The paper is devoted to the stability of residual stresses induced by pumping during cyclic and repeated static equiaxial bending. In order to predict the reliability and durability of parts, it is necessary to know not only the level of compressive residual stresses induced by the SPD, but also their stability during operation. Therefore, the study of the patterns of change in residual stresses under conditions close to operating conditions is of great scientific and practical importance.

A separate study of residual stresses in the zones subjected to compressive and tensile stresses from familiar-constant bending was carried out on specimens with and without stress concentrators. A fundamentally different pattern of changes in residual stresses in the compression and tensile zones under external loading was revealed. Thus, in the tensile zone, the residual stresses hardly change during loading, while in the compression zone, a significant decrease in the initial stress level and even a transition to tensile stresses in the case of repeated static loading are observed. The presence of structural stress concentrators leads to a more intense reduction in the level of residual stresses.

There is a correspondence between the results of fatigue tests on a crack in the compression zone and the nature of the change in residual stresses. A sharp change in residual stresses under the influence of cyclic compression leads to the fact that the first fatigue crack occurs on the surface in the compression zone.

The study suggests that in the case of alternating loads, the initial damage in high-strength steel parts hardened by SPD occurs during the compressive part of the cycle. Fatigue crack growth up to fracture occurs during the tensile part of the cycle.

It has been shown that the search for ways to improve the reliability of parts with a pressed bushing can be carried out both in terms of increasing the level of mechanical properties of the part material and, first of all, the surface layer, and in terms of structural changes of the assembly that can reduce the concentration of bending stresses at the bushing edge.