OS 10-02

THE INFLUENCE OF A STRESSED STATE OF WORKING SURFACES AND VARIOUS KINDS OF CHEMICAL HEAT TREATMENT ON COLD UPSETTING MATRIX DURABILITY

Victor M.Kenko*, Igor N. Sterpankin
P.O. Sukhoi State Technical University of Gomel
* Author for correspondence

ABSTRACT

KEY WORDS: Cold upsetting matrices, Friction, Tension, Kinds of Chemical Heat Treatment, Durability

Serviceability of cold upsetting tools is to a great extent determined by durability of matrices (female dies) that go out of service because of fatigue failure and moulding surface wear. Matrix durability can be improved by reducing the stresses occurring in the process of upsetting, applying materials having higher fatigue limit and also by changing the structure of moulding surfaces.

The paper objective is to study the influence of the tension value and the method of diffusion hardening of the surfaces on the durability of cold upsetting matrices. Matrices made of P6M5 steel used for manufacture of bolts of M22 x 70 and M22 x 140 size used for railway rails fastening were selected as the research objects. The influence of tension value on the rate of stresses occurring in the process of matrix pressing into a band case was estimated by numerical and experimental methods . Fatigue tests were conducted on the URS 20/600 Unit following the "tension-compression" pattern according to an asymmetric cycle of loading. Low temperature carbonitriding in the medium of triethanolamine dissociation products and carburetion in the medium of natural gas were selected as the method of hardening treatment.

It has been established that at the values of tension less than 0.2 mm their going out of service is caused by a fatigue failure. The highest matrix durability is achieved at 0.2...0.3mm tension. In this case matrix failure is caused by working surface wear accompanied by the manifestation of fatigue processes. When tension is increased to 0.4 mm the intensification of the tool impression wear is observed. This process at 0.5 mm and above tension is accompanied by contact fatigue of the surface metal layers.

The reduction of the intensity of accumulation of wear and fatigue failures of the matrix material is achieved by the use of diffusion hardening of the moulding surfaces. In the case of the billet form change only during working cavity filling the main influence on the matrix durability is provided by contact durability of the surface layer of an impression. Maximum matrix efficiency is provided by low temperature carbonitriding. In this case an improved intracrystalline ductility of nitrous martensite dissipates the energy, occurring in the working layer in the process of a billet deformation. For matrices the working cavities of which are used in billet moulding both on the stage of upsetting and when extruding a forging the main cause of failure is the impression wear. Its reduction is achieved by carburetion resulting in the working layer modified by a large number of special carbides of alloying components of P6M5 steel.