

deformation techniques (SPD), where a sample is subjected to the extremely high strains which are imposed at relatively low temperatures without changing cross-sectional dimensions of the samples. Many different SPD techniques are now available and summaries of these various procedures published in works of many scientists are in this several reviews. Nevertheless, major emphasis has been placed to date on the two techniques of ECAP and HPT and, accordingly, one of these procedures - ECAP will be used in this report.

Processing by ECAP uses a specially designed die consisting of two channels that are bent through a sharp angle near the die centre. The sample is usually pre-machined to fit tight the channel, and then is pressed through die using a plunger. The ECAP die is defined by two angles: the channel angle Φ represents the intersection angle of two parts of the channel, and second - the curvature angle Ψ that represents the angle at the outer arc of curvature where the two parts of the channel intersect. The cross-sectional dimensions of the work sample are not changed during processing thus the process can be repeated to obtain high strain accumulation.

The aim of the investigation is to shed light on the influence of the processing history on the microstructure and mechanical properties of the aluminium alloys. The influence of a processing condition will be discussed. Finally, the influence of the severe plastic deformation processes on structure, mechanical behaviour and the possibility of application of such processed materials will be described.

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ENABLING TRIBOTECHNOLOGY OF RUNNING-IN

The electrochemical-mechanical running-in (ECMR) is an improved tribotechnology of running-in. This method is used for running-in of basic units of engines and is one of perspective directions in research [1,2]. Application of the electrochemical - mechanical running-in has a number of substantial advantages before other types of final grinding in. Unlike the abrasive polishing in ECMR formation, abrasive particles are fully eliminated as products of wear. Affecting material is made by imposition of current on an environment and details and takes a

place at ionic level. As a result, products of output are in an environment as atoms and molecules. As well as at the electrochemical polishing, at ECMR there is a removal of internal tensions both in micro- and macro-volume of surface of material. ECMR allows making the local output of metal, but the surface passivation, characteristic for electrochemical process, absent here. In addition, ECMR provides joint running-in of details without application of the special instruments unlike abrasive and electrochemical processes, due to it there is rapid structural, micro- and macro-geometrical adaptation of the surfaces under friction. It enabled considerably to improve tribotechnical characteristics of the running-in surfaces at the different types of friction.

To conduct error analysis, select factors, influencing on the change of size the error of form of detail $d\delta/dt$ and relation of speed of electrochemical output on an area with the depassivation of surface to speed of output on an area without a depassivation V_{ad}/V_a . Assume that material of detail on the area of the mechanical activating is taken off as micro-volumes of metal, then

$$V_{\max} = \frac{d\delta_{\max}}{dt} = V_m + V_{elc} = V_m + V_{ad} - V_a, \quad (1)$$

where V_m - speed of mechanical output; V_{elc} - speed of electrochemical output; V_{ad} - speed of anodal dissolution of metal with mechanical depassivations; V_a - speed of anodal dissolution of metal without mechanical depassivations.

Knowing that the Sommerfeld criterion which is evened $S_m = 10^{-5}$ corresponds transient regime of friction, easily to set the change of types of lubrication at running-in surfaces. In an initial period of time there is mechanical elimination or driving back of plastic materials, forming an initial area of contact (I stage). With its growth, a transition is possible from a semi liquid friction to hydrodynamic (II stage), and at the hydrodynamic regime of friction the spot of contact is finally formed in examined tribosystem (III stage). The evident picture of terms of transition of one mode of friction f in other gives diagram of Gersi, in which the coefficient of friction is related to the parameter $\mu V/P$. This parameter is named description of the bearing mode. On diagram line $S_m = 10^{-5}$, passing through the point of a minimum of coefficient of friction, divides the areas of friction at a liquid and other types of lubricating (Fig. 1).

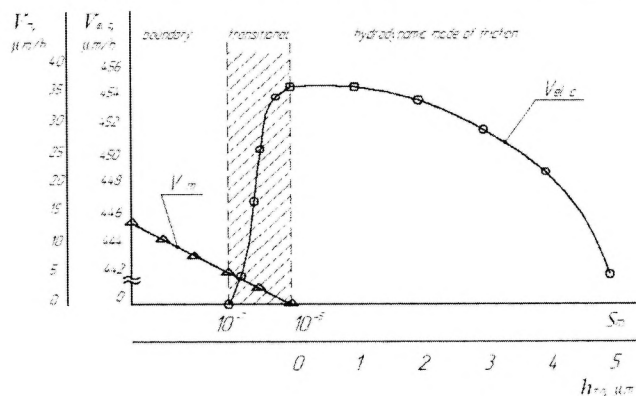


Fig.1. Speed of diminishing of macro-geometrical detail's form error at ECMR

As obvious from Fig. 1, diminishing of macro-geometrical form defection $d\delta/dt$ due to a mechanical wear V_M possibly only at the dry and limiting types of friction. Thus, then more surfaces are divided the layer of lubricating, the less than influence of mechanical wear on the process of improvement of macro-geometry of details surface. The mechanical factor is absenting at a liquid friction. Influence of electrochemical factor increases with the division of the running-in surfaces the layer of electrolyte (V_{ad} increases at a limiting friction). However, it is necessary to provide a minimum gap; because resistance of layer of electrolyte grows with its increase those results in deceleration of electrochemical reactions (V_a goes down at a liquid friction with growth of thickness of electrolyte layer). Experimental confirmation of improvement of tribotechnical descriptions of friction surfaces at ECMR is presented in [3]. The use of this high-efficiency method of forming of surfaces of details allows considerably increasing their resource.

An alternating electric current on the friction surface coupling a piston-cylinder accelerates the running-in of the contact surfaces at the misalignment of their axes. ECMR of the basic conjugations of engines is the high-efficiency process of running-in of the running-in surfaces: except for mechanical influence, characterized V_M , the process of running-in is accelerated due to electrochemical processes.

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