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PECULIARITIES OF PLASTIC FLOW OF METALLIC AND POLYMERIC MATERIALS UNDER SEVERE PLASTIC DEFORMATION BY PLANAR TWIST EXTRUSION

By the example of aluminum alloy and polyamide-6, plastic flow of metal and polymer under severe plastic deformation implemented by the planar twist extrusion (PTE) was studied. The mentioned process is of certain advantages; it retains the main features of the conventional twist extrusion. This fact allowed using the affinity of the processes during investigation. The experimental data were obtained with the use of elements of an experimental-calculation method, involving the introduction the marker-fibers to the billet. It was shown, the revealed overflow effect taking place at planar twist extrusion is caused by the presence of the «open-ended» and «shear» components of the plastic flow of material. It was found that the overflow is more strongly expressed in the case of metal compared with the polymer. It is assumed, that this feature of plastic flow can be the reason of observed differences in the hardness distribution over the cross section of investigated extrudates.

Keywords: severe plastic deformation, plastic flow, planar twist extrusion, aluminum alloy, polyamide-6

Fig. 1. Schemes of PTE (*a*), TE (*b*) and succeeding cross-sections of the channels at PTE (*c*) and TE (*d*)

Fig. 2. Scheme of the billet to be tested

Fig. 3. Cross-sections of the aluminum billet (*a*, *c*) and the polyamide billet (*b*, *d*) in the initial state (*a*, *b*) and after one pass of PTE (*c*, *d*); comparison of marker positions before (solid markers) and after PTE (blank markers) (*e*, *f*)

Fig. 4. Hardness distribution in the aluminum sample: *a* – the initial cast one, *b* – after one PTE pass

Fig. 5. Hardness distribution over the cross-section of the extruded PA-6