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BOOK OF ABSTRACTS

Gradient Nanocrystalline Structure Formation Using Vibration-Centrifugal Hardening

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Severe plastic deformation (SPD) is the way of obtaining compact nanomaterials and sub-microcrystalline materials. Vibration-centrifugal hardening (VCH) is one of the existing methods of SPD used for surface improvement of machine elements. The essence of VCH is that the special circumferential tool with the balls inside rolls on the external or internal surface of the cylindrical element, which makes vibrating oscillation of some amplitude and frequency, making dynamic impact loads [1]. These conditions tend to increase the depth (up to 6 mm) and microhardness (up to 8 GPa) of the surface layer by increasing of contact stress in the working area. The method is based on the formation of the highly fragmented and disordered structure with features of recrystallized amorphous state. VCH significantly reduces the dispersion of structure (the average number is 18 nm). Nanocrystalline structure has the low index of friction. Mesomechanics of SPD depends not only on the deformation degree but also on deformation mode. Obtained structures of the surface layers work successfully in the oil liquid at temperatures not exceeding 200 Celsius degree. Research of wearing quality and index of friction determination were performed on friction machine by the following scheme: ring – tab in the olive environment and in the olive-abrasive environment. Sample rings were made of steel 40Kh. Wearing quality of the surface layer after VCH was compared with wearing quality of the samples after air-hardening and hardening with low tempering (200 Celsius degree). VCH increases the wearing quality of the samples in 1.4-2.3 times (for wear in oil) and in 2.9 times (for wear in abrasive mass). Pilot tests showed that the wearing quality of bushings made of steel 40Kh increased in 2.3 times.

1. *I. S. Aftanaziv, A. I. Bassarab, and Ya. B. Kyryliv,* "Mechanical and Corrosion Characteristics of 40Kh Steel after Vibration-Centrifugal Hardening Treatment," in: Materials Science, Volume 38, Issue 3, 436–441 (2002).