Ni-based and Zr-based bulk metallic glasses: Changes in mechanisms of friction and wear

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Abstract

Metallic glasses (amorphous metal alloys) (1) obtained by thermoforming (2) are good candidates for the design of surfaces for tribological purposes. Their potential interest has been highlighted in different tribological applications (3, 4, 5). Controlling the composition of metallic glasses allows to adjust their plastic behaviour or their sensitivity to oxidation.
Friction tests are performed using a pin-on-plane configuration, in reciprocating kinematics, at room temperature. Tests are conducted with a linear speed of 4 mm/s over 1 and 20 cycles. The planes are of metallic glasses, Nickel base and Zirconium base, presenting different Young modulus and glass transition temperature. Their amorphous nature is ascertained by X-ray diffraction (XRD). 100C6 steel pins of 70 mm radius are used as the counterface material. The initial maximum Hertz pressures are 160 and 290 MPa. Normal load is applied using dead weights. Tangential force is measured at a sampling rate of 12800 Hz using a piezoelectric sensor (underneath the sample stage). The surface features are analysed using a combination of optical interferometer, DRX, scanning electron microscopy, X-ray spectrometry. Sub-surfaces region of wear tracks are revealed by cross-sectioning. Damage and shear bands are highlighted, linked with friction coefficient evolution and on function of the metallic glasses' compositions.
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