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Structural changes in WC-TiC-Co hard alloy and Mo coating – hard alloy system as a result of compression plasma action

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Irradiation technology is one of the most promising techniques for surface hardening of hard alloys which are characterized by high residual porosity and large variation in the carbide particles dispersion. The goal of this paper is to study the influence of compression plasma flows (CPF) in nitrogen atmosphere on structure and mechanical properties of WC-15TiC-6Co (wt. %) hard alloy and hard alloy with deposited Mo coating. CPF with submillisecond duration allows not only to synthesize hard melting layer consisting of supersaturated carbide solid solution due to melting, mixing and a high cooling rate but also to alloy uniformly this layer with additional metals and to saturate it with plasma-forming gas.
X-ray diffraction analysis revealed that after treatment with absorbed energy density (JE) less than 19 J/cm^2 TiN, W2N and Mo2N nitride phases are formed in the surface layers. That is due to partial decomposition of carbides and diffusion of Ti and W to surface layer and enrichment of melt with nitrogen. W2C and Mo2C carbide phases were also found. Further increase of JE (27 J/cm^2) leads to formation of uniform melted layer (~ 6 μm) phase composition of which corresponds to a (Ti,W)C solid solution. Nitride phases were not detected as nitrogen diffusion in material is complicated by ablation intensity increase. In case of deposition of Mo coating the melted layer (~ 4 μm) is alloyed by molybdenum (6,3±1,4 at.%). It was established that microhardness of the investigated systems' surface layers increases by more than twice as result of formation of highly modified layer with superfine structure alloying by molybdenum for Mo-hard alloy system as well as precipitation of the second phases. Tribological tests showed the decrease of friction coefficient in 3-3.5 times after CPF for both cases, modified layer has improved wear resistance.

Keywords
hard alloy
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