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Microstructure and thermal stability of Mo-(Ag)-N coatings with high nitrogen content

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Abstract

The interplay between the chemical composition and the microstructure of nitrogen-rich Mo-(Ag)-N coatings deposited by reactive magnetron sputtering was investigated using a combination of wavelength-dispersive X-ray spectroscopy, glancing-angle X-ray diffraction and transmission electron microscopy with high resolution. It was proven that the microstructure of the coatings, in particular the amount of hexagonal and cubic molybdenum nitrides, can be controlled by the nitrogen partial pressure in the deposition apparatus. In the as-deposited coatings, a metastable nitrogen-rich cubic phase of molybdenum nitride was detected, which decomposed into the thermodynamically stable cubic Mo_2N and hexagonal MoN upon annealing at 600°C. The mechanisms stabilizing the metastable cubic phase are discussed. Silver is only marginally soluble in the molybdenum nitrides, thus its addition leads mainly to the interruption of the growth of the Mo-N crystallites and to the grain refinement in the Mo-Ag-N coatings. The small amount of silver, which is incorporated into the crystal structure of the molybdenum nitrides, affects predominantly the thermal stability of the metastable cubic phase.

Keywords: Mo-Ag-N, Reactive magnetron sputtering, Thermal stability, Stacking faults, Glancing-angle X-ray diffraction, High-resolution transmission

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