Studies of multilayer TiN/MoN coatings deposited on a previously nitrided surface.

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Intensively developing and competing industry requires constant cheapening of costs for the re-equipment of technological chains in production. In the machine building industry, there are constant problems associated with hardening the surface of machine parts and aggregates. Hardening is achieved by nitriding the surface or applying a protective coating. Of great interest is the deposition of a multilayer coating of TiN/MoN on the previously nitrided surface in a single technological cycle.

Nitriding and coating were carried out on a modernized vacuum-arc plant "Bulat-6". Nitriding of stainless steel leads to an increase in hardness from 2 GPa to 9 GPa. X-ray diffraction studies of the nitrided layer determined the S-phase with a lattice period of 0.381 nm, which corresponds to the formula $FeN_{0.4}$. The crystallite size averaged 3.2 nm [1].

The depth of the nitrided layer of stainless steel 12X18H10T is 20 μm for 30 minutes (Fig. 1). In stainless steels, ion nitriding accelerates the efficiency of nitride formation with chromium. A multi-layer coating TiN/MoN with a hardness (up to 50 GPa) and a thickness of up to 20 μm was deposited on the nitrided surface.

Deposition of TiN/MoN coatings with a thickness of 5 nm leads to the formation of a two-phase state of γ-Mo_2N and TiN with a crystal lattice (fcc of the NaCl type) [2]. It is determined that the thickness of the multilayer coating is ~ 10 μm (Fig. 1). A decrease of Ti and Mo in the coating and simultaneous growth of Cr, Fe, Ni indicates diffusion processes that occur between the coating and the substrate at a depth of 11-13 μm.

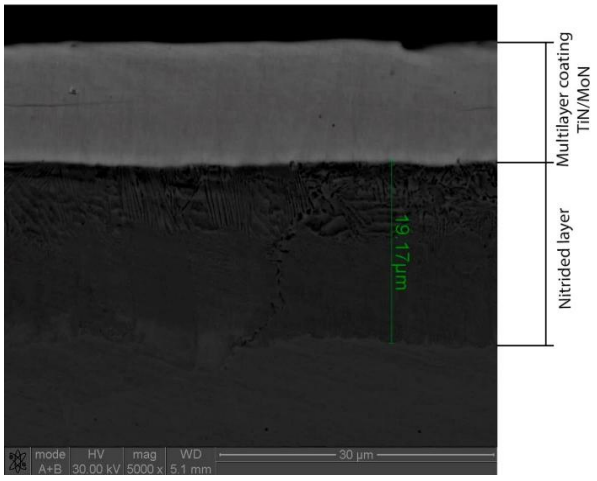

Fig. 1. Cross-section of a nitrided layer with a multilayered TiN/MoN coating

The amount of nitrogen in the vacuum-arc TiN/MoN coating is slightly higher than in the nitrided layer of stainless steel 12X18H10T. A small decrease in the amount of nitrogen in the steel occurs at 35 μm, but the actual diffusion of nitrogen occurs at a depth of 64 μm.

The development of a method for hardening the surface by preliminary nitriding the material surface with subsequent application of an superhard multilayer coating allows increasing the service life of the cutting tool and rigging. In particular, this method was used to strengthen the matrix, which showed an increase in the service life by more than 8 times.

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2. *Андреев А.А., Соболь О.В., Горбань В.Ф., Столбовой В.А., Мамон В.В*. Исследование фазового состава, структуры и свойств многослойных вакуумно-дуговых нанокристаллических покрытий Ti-Mo-N // ФІП, 2010, т. 8, № 1, с. 28 – 35.