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Low-energy Ion Sputtering of Ultrafine Grained Tungsten by Ar^+ Ions

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Распыление Ультрамелкозернистого Вольфрама Ионами Ar^+ Низких Энергий

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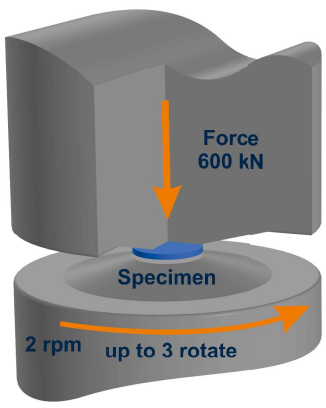
Abstract

It has been shown that the relief on the ultrafine graine tungsten differs substantially from the relief on the coarse-grained tungsten, formed in result ion sputtering by argon ion. Sputtering of the surface of ultrafine-grained tungsten occurs more evenly than coarse-grained tungsten. It is assumed that the forming surface on ultrafine graine tungsten will be more resistant to sputtering than of the coarse-graine counterparts.

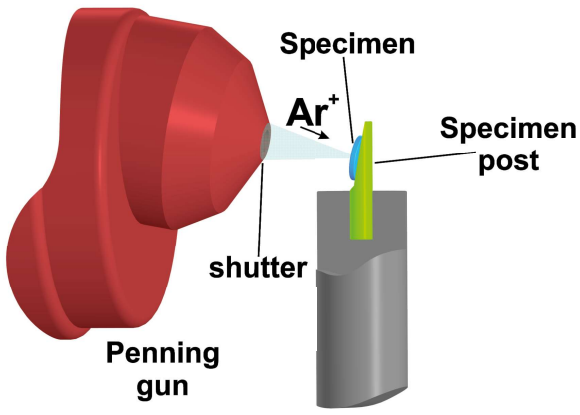
Experimental



High Pressure Torsion
Tungsten with Purity of 99.95%

→

Grinding and Polishing →



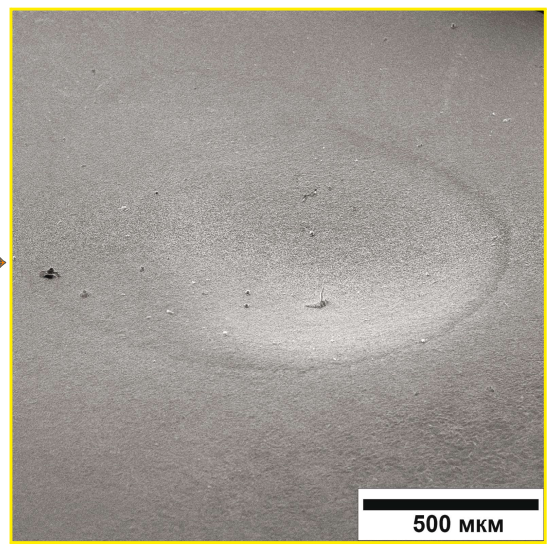
Sputtering by Gatan 691, at Normal, 5 keV
and Fluence 10^{19}-10^{20} ions/cm^2 →

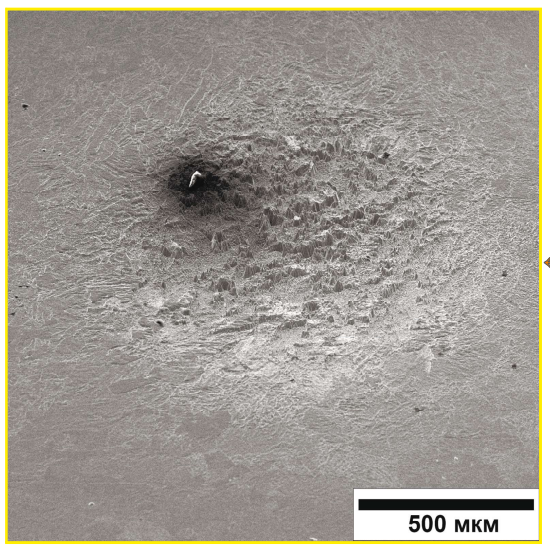
Surface Investigation
Using SEMTescan MIRA 3

Results

Ultrafine Grained Tungsten ← vs → Coarse Grained Tungsten

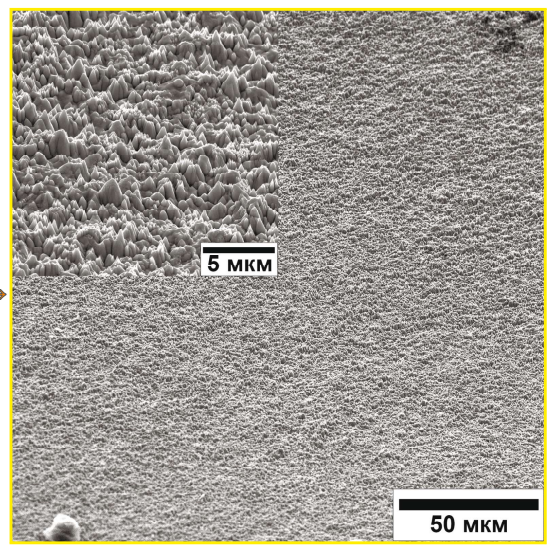
Crater From Ion Sputtering on the Surface of Ultrafine Grained Tungsten →

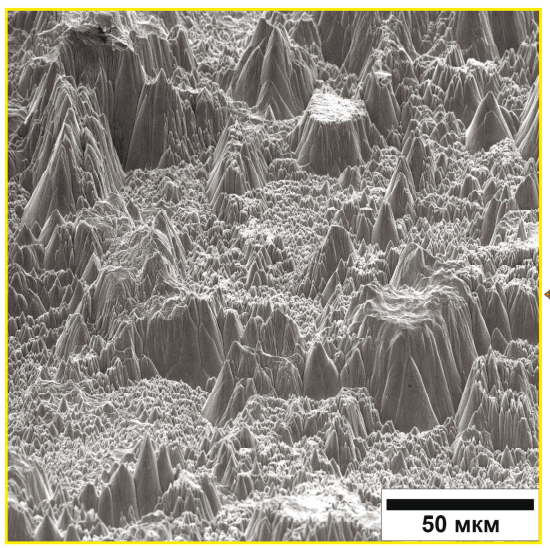




← Crater From Ion Sputtering on the Surface of Coarse Grained Tungsten

Centre of Crater From Ion Sputtering on the Surface →





← Centre of Crater From Ion Sputtering on the Surface

Conclusion

The formation at the initial stage of ion sputtering of an erosion relief on ultrafine grained tungsten, consisting of uniformly distributed and homogeneous protrusions of submicron dimension, contributes to the rapid achievement and maintenance of the stationarity of the ion sputtering process. It is expected that due to the geometric features of the resulting surface, it will be more resistant to sputtering. At the same time, the relief formed on the surface of coarse grained tungsten during sputtering will contribute to the unsteadiness of the sputtering process due to the pronounced selectivity of sputtering of grains with different crystallographic orientations.

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Electron microscopic studies were carried out on the facilities of shared services center of the