PRODUCING ULTRA COMPOSITION TiN-Cu USING MAGNETO-PLASMA ACCELERATOR EROSION TYPE COMBINED ACCELERATOR CHANNEL

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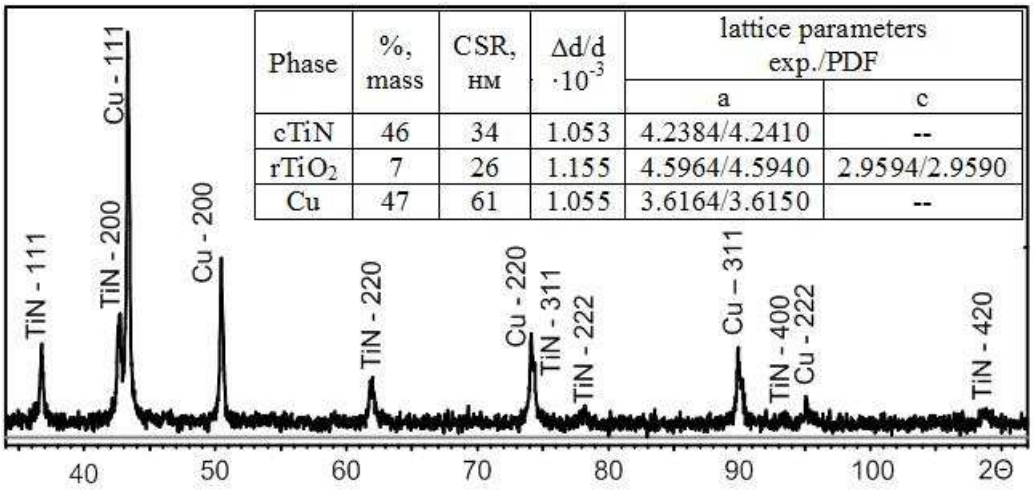
In [1] have demonstrated a significant increase in the physical and mechanical characteristics of the material based on titanium nitride by the introduction of copper supplements in the amount of 10-12%. The microhardness of the coatings of this type is close to 40 GPa. A method of obtaining ultrafine composition TiN-Cu using a coaxial magneto-plasma accelerator (CMPA) [2]. Experiments were carried out for values of input energy 22 kJ and 80 kJ. In the accelerating channel contains four copper wire with a diameter of 2.0 mm. Fig. 1 shows the XRD-pattern of powder materials obtained in experiments with energy parameters W= 80 kJ, as well as basic data full-profile X-ray analysis: the ratio of crystalline phases in weight percent, the average size of coherent scattering regions (CSR); the value of internal microdistortions Δd/d, and lattice parameters.



Phase	%, mass	CSR, нм	Δd/d ·10^{-3}	lattice parameters exp./PDF	
				a	c
cTiN	46	34	1.053	4.2384/4.2410	--
rTiO$_2$	7	26	1.155	4.5964/4.5940	2.9594/2.9590
Cu	47	61	1.055	3.6164/3.6150	--

Fig. 1. X-ray diffraction data and X-ray analysis

X-ray analysis shows that the primary crystal phase of the obtained product is a dynamic synthesis cubic titanium nitride, titanium dioxide with a rutile structure and copper crystalline. The copper content can be controlled in a wide range by the energy supplied to the accelerator (approximately 4% at 22 kJ of energy and approximately 48% at an energy of 80 kJ).

As seen from the micro-electronic analysis (fig. 2) product includes three phases: titanium nitride, copper and titanium dioxide with a rutile structure, uniquely corresponding three-phase system cTiN, cCu and rTiO$_2$. Cluster consists of particles ranging in size from 70 nm to 100 nm.

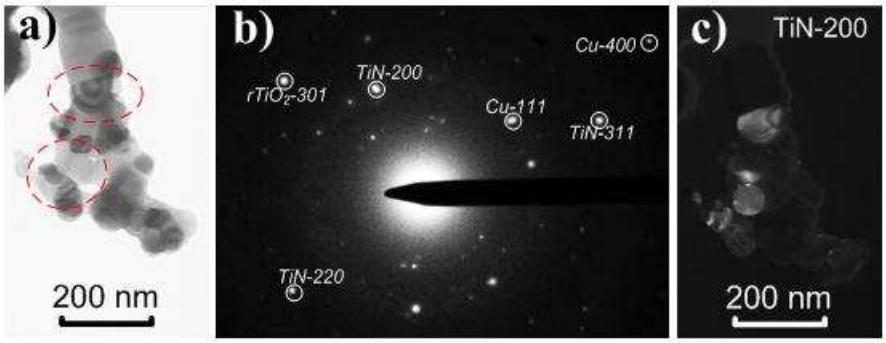


Fig. 2. These TEM-investigations composite powder material of TiN-Cu: a) light-field image b) electron diffraction, c) dark-field image in the reflex TiN-200.

REFERENCES

[1] *N.N Koval et al.* // Proceedings of the universities. Physics. 2007 - №2 - pp. 46-51.

[2] *Sivkov A.A., Nayden E.P., Gerasimov D. Yu.* // Superhard materials. Kiev. - 2008. - № 5. - pp. 33-39.