

Nanocomposites and nanomaterials

The influence of element composition on the phase composition and mechanical properties of $\text{WB}_2\text{-TiB}_2$ system ion-plasma coatings

O.A. Shovkoplyas¹, O.V. Sobol'², M.Y. Arsenko³

¹ *Department of Complex Systems Modeling, Sumy State University,
2, R-Korsakov Str., 40007 Sumy, Ukraine
E-mail: o.shovkoplyas@mss.sumdu.edu.ua*

² *Department of Materials Science, National Technical University "Kharkiv
Polytechnical Institute", 21, Frunze Str., 61002 Kharkov, Ukraine
E-mail: sool@kpi.kharkov.ua*

³ *Joint Research Centre "Diagnostic of structure and properties
of nanomaterials", Belgorod State National Research University,
85, Pobedy Str., 308015 Belgorod, Russia
E-mail: arsenko@mail.ru*

The introduction of modern progressive technologies requires the creation of new and improvement of known materials that have excellent performance characteristics. One of the promising ways as to increasing hardness, strength and crack-resistance of machine elements, structures and tools surface is the deposition of $\text{WB}_2\text{-TiB}_2$ quasi-binary system materials [1].

The article shows that the appearance of a two-phase condition, consisting of $\beta\text{-WB}$ and $(\text{Ti,W})\text{B}_2$ -phases, is possible for the ion-plasma coatings obtained by means of magnetron sputtering of $\text{WB}_2\text{-TiB}_2$ -targets with different proportions of TiB_2 - and WB_2 -components. The $\beta\text{-WB}$ -phase is present in the coating with the share of Ti atoms less than 15%. It is found that the transition into two-phase state increases the hardness and strength of the coating. The hardness reaches the value of 60 GPa if the value of titanium content equals 5–15 at.%. The obtained results can be explained by the atom ordering (with spinodal decomposition) and the appearance of spaced of hardening nanodimensional particles, which take place in process of deposition with the above mentioned compositions.

Using scratch-testing is was found that to increase adhesive strength it is necessary to use the substrates with hardness close to that of the coating.

1. Hardness and adhesive strength of ion-plasma coatings of $\text{TiB}_2\text{-WB}_2$ and TiC-WC quasi-binary systems / O.V. Sobol', O.A. Shovkoplyas, P.A. Srebnik, M.Y. Arsenko // Physical Surface Engineering. – 2015. – **13**, № 1. – P. 67–76.