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TRIB-P2-056 ● Properties of tungsten-tantalum diboride coatings deposited by High power impulse magnetron sputtering (HiPIMS)

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We present the deposition and characterization of tungsten-tantalum diboride (W,Ta)B_2 coatings prepared by the high-power impulse magnetron sputtering technique. We evaluated the influence of pulse duration and substrate bias on the properties of (W,Ta)B_2 films. A high hardness of up to 35 GPa measured by nanoindentation was simultaneously obtained with good elastic properties. Changing the pulse duration greatly affected the B/(Ta+W) atomic ratio, which influenced the properties of the coatings. Figure 1 shows the inverse relation of boron content and mechanical properties of coatings, similar studies were done by Fuger et al.[1] by means of density functional theory. On the basis of X-ray diffraction, we determined that coatings consist mainly of WB_2 -P6/mmm phase. Increasing the bias voltage led to change of structure from nanocrystalline to amorphous/nanocrystalline. The deposited films are thermally stable up to 1000°C in vacuum and are able to withstand oxidation at 500°C.

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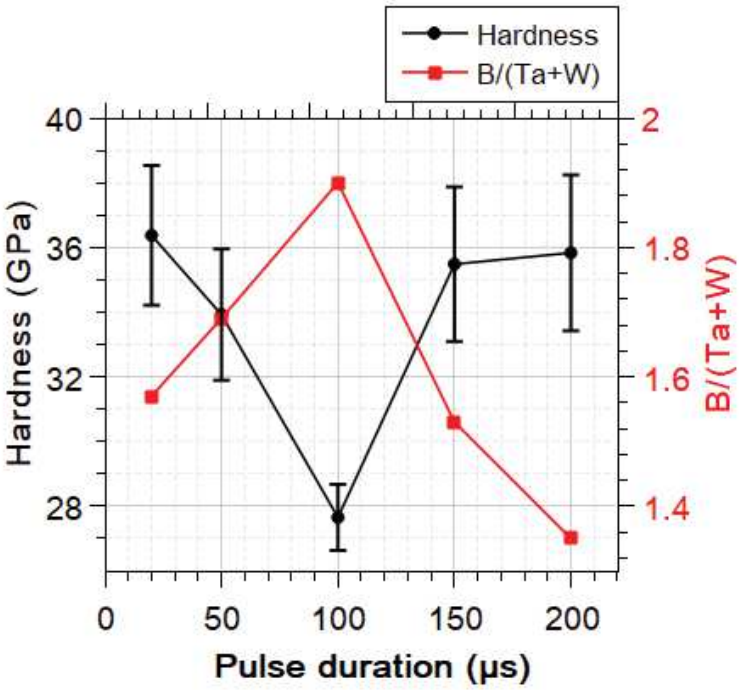
References
[1]C. Fuger, R. Hahn, L. Zauner, T. Wojcik, M. Weiss, A. Limbeck, O. Hunold, P. Polcik & H. Riedl (2022) Anisotropic super-hardness of hexagonal $WB_{2\pm z}$ thin films, Materials Research Letters, 10:2, 70-77, DOI: 10.1080/21663831.2021.2021308



Hardness and B/(Ta+W) vs pulse duration