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INNOVATIONS IN THIN FILM
PROCESSING AND CHARACTERIZATION



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ABSTRACT BOOKLET

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P2.17-039 - PULSED LASER DEPOSITION OF SUPERHARD RHENIUM AND TUNGSTEN BORIDES

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$\text{Re}_{1-x}\text{W}_x\text{B}_2$ are novel superhard materials [1,2]. The partial substitution of rhenium by tungsten in ReB_2 , besides increasing of the hardness, reduces the manufacturing costs of the material. Till now there is no information about SPS sintering and pulsed laser deposition of $\text{Re}_{0.5}\text{W}_{0.5}\text{B}_2$, WB_2 materials as a thin films. In this work ReB_2 , $\text{Re}_{0.5}\text{W}_{0.5}\text{B}_2$, WB_2 bulk samples were obtained via SPS synthesis technique and subsequently used as targets for films preparation by the pulsed laser deposition method. Coatings were prepared on Si (100) substrate using laser beam with 355 nm wavelength of nanoseconds Nd:YAG laser. The sintered targets and deposited films were studied by X-ray diffraction, scanning electron, optical profilometer, and Vickers nano- and microindentation technique. After 90 min of deposition at the substrate temperature 570°C and laser fluence 4.9 J/cm² the thickness of films is: ReB_2 – 0.7 μm, $\text{Re}_{0.5}\text{W}_{0.5}\text{B}_2$ – 0.3 μm, WB_2 – 1.4 μm

The surfaces of deposited coatings are presented in figure 1.

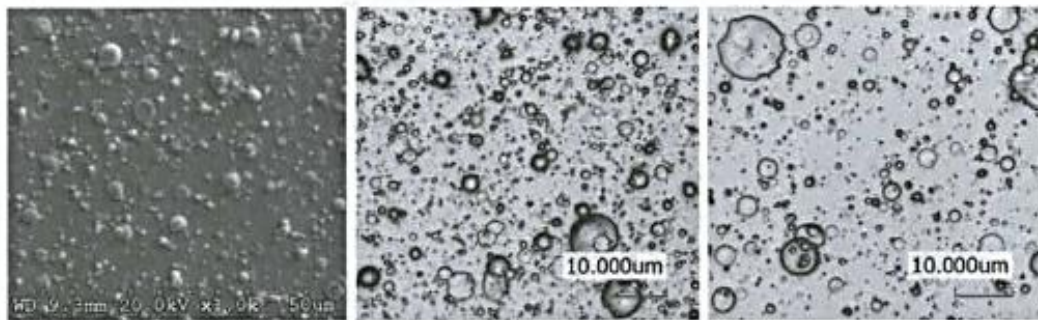


Fig. 1. Micrographs of deposited films (magnification ×1000): a) ReB_2 , b) $\text{Re}_{0.5}\text{W}_{0.5}\text{B}_2$, c) WB_2

The nanoindentation test with the load 5mN show that all films are superhard with hardness: ReB_2 – 61.6±5.2 GPa, $\text{Re}_{0.5}\text{W}_{0.5}\text{B}_2$ – 51.8±5.3 GPa, WB_2 – 60.4±3.2 GPa.

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