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ABSTRACT BOOKLET

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**P2.11-030 - THE EFFECT OF SUBSTRATE HEATING ON THE
ReB₂ LAYERS DEPOSITED BY PLD METHOD**

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Rhenium diboride (ReB₂) was proposed as superhard material which can be used as an alternative to diamond [1]. The material might be a great perspective to manufacturing hard, wear resisted coatings capable to increase a tool life. Furthermore the ReB₂ layers grown by Pulsed Laser Deposition (PLD) method has been already reported [2]. Because of the promising industrial potential of the compound it is important to know its behaviour in elevated temperature. ReB₂ thin films have been deposited on Si substrate by PLD method using Nd:YAG laser (wavelength 1064 nm, pulse duration 10 ns, fluence 4 or 9 J/cm², repetition rate 10 Hz). The effect of substrate heating and postannealing on the properties of layers was investigated. Coatings formed at room temperature (RT) and at temperature of 570°C were compared. Samples deposited at 570 °C were annealed immediately after deposition in vacuum during 25 min in temperature of 350°C. The thickness of all layers was of the order of several hundred nanometres. Heating the substrate did not change significantly the efficiency of deposition. The amounts of deposited material at RT and 570°C are in proportion to the fluence. The roughness and the number of droplets on the surface of ReB₂ layer slightly increased in case of the heated substrate. X-ray diffraction pattern of sample deposited at RT shows partially amorphous character. The XRD analysis of samples deposited at 570 °C indicate the crystalline ReB₂ with preferred (002) orientation and fine grain size of about 20 nm. The reasons for strong (002) orientation and shift of the (002) peak were analysed. The annealing did not cause significant smothering of surface of ReB₂ coatings. However, it changes intensity ratio of (002) and (101). The explanation has been found. XRD patterns of annealed layers are in Fig. 1.

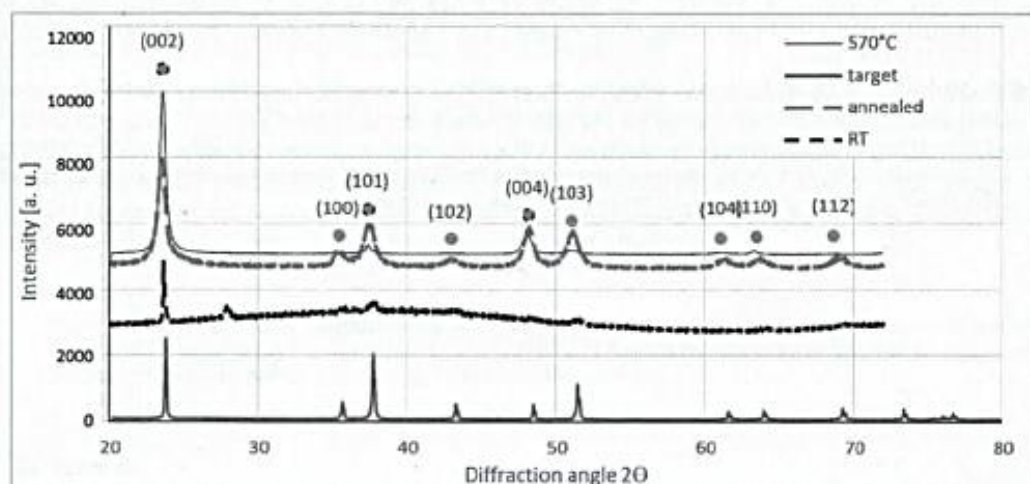


Fig. 1. XRD pattern of ReB₂ films and SPS ReB₂ target

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References:

- [1] L. Ivanovski, Microhardness of Compounds of Rhenium with Boron, Carbon and Nitrogen. *J. Superhard Mater.*, 34 (2) (2012) 75-80
- [2] A. Latini, J. V. Rau, D. Ferro, R. Teghil, V. R. Albertini, S. M. Barinov, Superhard Rhenium Diboride Films: Preparation and Characterization, *Chem. Mater.*, 20 (2008) 4507-4511