Investigation of superfast deposition of metal oxide and Diamond-Like Carbon thin films by nanosecond Ytterbium (Yb+) fiber laser

Titre	Investigation of superfast deposition of metal oxide and Diamond-Like Carbon thin films by nanosecond Ytterbium (Yb+) fiber laser
Type de publication	Article de revue
Auteur	Serbezov, V. [1], Sotirov, S. [2], Benkhouja, K. [3], Zawadzka, Anna [4], Sahraoui, Bouchta [5]
Editeur	Elsevier
Type	Article scientifique dans une revue à comité de lecture
Année	2013
Langue	Anglais
Date	11/2013
Numéro	1
Pagination	53-59
Volume	36
Titre de la revue	Optical Materials
ISSN	0925-3467
Mots-clés	ablation [6], amorphous-carbon [7], DLC thin films [8], Metal oxides thin films [9], Nanosecond Yb+ fiber laser [10], PLD [11]
Résumé en anglais	Metal oxide (MOx, M: titanium, magnesium) and Diamond-Like Carbon (DLC) thin films were synthesized by Pulsed Laser Deposition (PLD) at room temperature and low vacuum of 2 Pa for MOx and vacuum of 4 x 10(-3) Pa for DLC films. A fiber based Ytterbium (Yb+) laser operating in the nanosecond regime at a repetition rate of 20 kHz was used as an ablation source. Dense and smooth thin films with a thickness from 120 to 360 nm and an area of up to 10 cm(2) were deposited on glass and stainless steel substrates at high growth rates up to 2 nm/s for a laser intensity of 10-12 J/cm(2). The thin films synthesis was compared for two fiber laser modes of operation, at a repetition rate of 20 kHz and with an additional modulation at 1 kHz. The morphology, chemical composition and structure of the obtained thin films were evaluated using optical microscopy, Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDX) and Raman spectroscopy. The morphology of the MOx thin films and the deposition rate strongly depend on the fiber laser mode of operation. Very smooth surfaces were obtained for the metal oxide thin films deposited at lower deposition rates in the modulation mode at 1 kHz. The effect of the substrate on the DLC film structure was studied. The films deposited on dielectric substrates were identified as typical tetrahedral (ta-C) DLC with high sp(3) content. DLC films on metal substrates were found typical a-C amorphous carbon films with mixing sp(2)/sp(3) bonds.
URL de la notice	http://okina.univ-angers.fr/publications/ua3198 [12]

DOI 10.1016/j.optmat.2013.05.015 [13]

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[13] http://dx.doi.org/10.1016/j.optmat.2013.05.015