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OSMARY DEPABLOS-RIVERA: Analysis of plasmas produced by pulsed laser ablation combined with magnetron sputtering.

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The plasma diagnostic is an in-situ method to monitor the deposition processes that involve the generation of plasmas. The pulsed laser ablation (PLA) and magnetron sputtering (MS) are plasma-assisted deposition techniques. Their combination is known as hybrid technique and denoted as MS-PLA. This hybrid technique has been employed to prepare coatings and films with specific applications such as solid lubrication, photocatalysis and biomedical materials. We implemented the hybrid technique MS-PLA to prepare films of ZnO-Au, an Au target was ablated and MS was used to deposit ZnO. The aim of this work was to diagnose the plasmas generated during the hybrid deposition by optical emission spectroscopy (OES). Additionally, the plasmas produced during the PLA of an Au target in high vacuum and under an Ar atmosphere (0.67 Pa) were studied. These PLA plasmas were studied as reference to understand the effects of the plasmas combination in the hybrid process MS-PLA. The processes with PLA were done varying the pulse laser fluence at 4.5, 13.6 and 20.9 J cm-2. The OES results allowed to identify and to analyze the emission evolution of neutral atoms of Au, Ar and Zn and single-ionized Au atoms. The loss of material from the growing films was evidenced during the PLA of Au under Ar atmosphere because the emission of Au neutral atoms increased in front of the substrates. However, the increase of Au emission near the substrates did not occur during the hybrid deposition, while the increase of the Zn emission was observed. The Zn excitation revealed the energy loss of the Au species by the collisions, and their final energy caused less removal of material from the films with respect to the PLA process in Ar. Consequently, the deposition rate improved in the hybrid process.

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