# Growth Evaluation and Electrochemical properties of $LaB_6$ thin films deposited by HiPIMS

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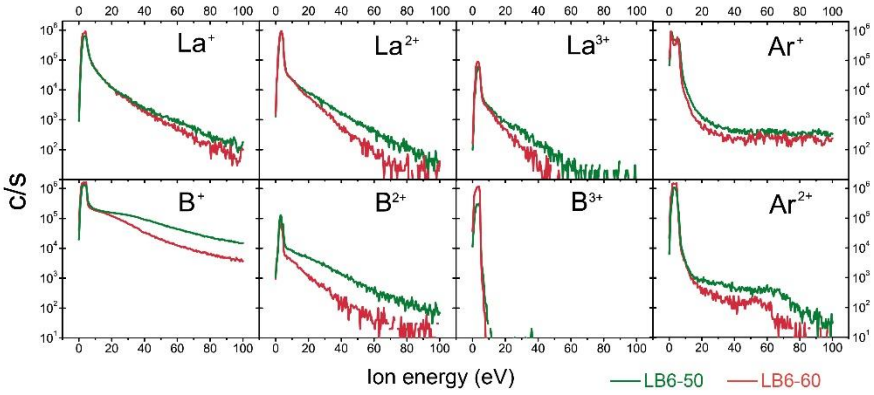
## Abtract

Lanthanum hexaboride ($LaB_6$) thin films are widely used due to their exceptional electron emission, thermionic and interesting mechanical properties. The $LaB_6$ has a crystal structure, increasing the hardness and improving the mechanical properties. Besides, the LaB6 films can promote scavenger effect, that decrease surface impurities that could contribute to the corrosion increments, and the highly reactivity with oxygen also helps to increase the resistance to corrosion. However, the obtention of these properties can also present challenges in the physical vapor deposition processes of thin films. In this sense, the High Impulse Magnetron Sputtering (HiPIMS) deposition parameters such as the pulse width can influence in the morphology, density of the films. In the present study we analyze the influence of duty cycle of the deposition processes on the ionization, bonding, structural and electrochemical properties of the films. Two films were deposited on silicon 001 and 52100 metallic alloy, varying the pulse width (50 and 60 µs). The ion energy distribution function (IEDF) of the $LaB_6$ species in the plasma deposition was evaluated by the IEDF curves obtained by quadrupole mass spectrometer detector. The morphology and thickness of the $LaB_6$ thin films were analyzed from cross-sectional images using field-emission scattering electronic microscope (FESEM). Electrochemical Impedance Spectroscopy (EIS)



was made of the two films deposited on the metallic alloy. Raman spectroscopy and X-ray diffraction revealed higher crystallinity in the 50-film. Furthermore, this film showed better corrosion resistance. These results demonstrated how the pulse width and duty cycle in the HiPIMS process can significantly influence the crystallinity and overall quality of $LaB_6$ thin films.

Abstract