Effect of peak target power on the properties of Cr thin films sputtered by HiPIMS in deep oscillations magnetron sputtering (DOMS) mode.

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The advent of High-power Impulse Magnetron Sputtering (HiPIMS) and its variant Modulated Pulsed Power Magnetron Sputtering (MPPMS) allowed a new knob to control the flux of sputtered species, i.e., a new knob to control the kinetic effects on the growing film. Recently, a new design of the MPPMS pulses has been proposed to reduce arc generation. This form of high power pulses has been named deep oscillation magnetron sputtering (DOMS). In this work, the influence of the kinetic effects induced by a DOMS discharge on Cr sputtered thin films was studied and compared to a DCMS discharge. The Cr thin films were deposited with increasing peak power at the same average power (1.2 kW) in order to minimize changes in the thermal effects that also influence film growth. The influence of the peak power on the morphology, structure and mechanical properties of Cr thin films was studied. The Cr films deposited by DCMS have a columnar morphology, a [110] preferential orientation, hardness between 7.2 e 8.5 GPa and a maximum Young modulus of 255 GPa, always lower than the value of the bulk material. Although substrate polarization up to -110 V was used, some porosity always remained in the DCMS films. The deposition rate of the Cr films deposited by DOMS decreases from 60 to 30 % of the DCMS deposition rate with increasing peak power. The films also have a [110] preferential orientation. Increasing the peak power changes the film morphology from columnar to dense, increases the hardness up to 17 GPa, increases the lattice parameter and decreases the grain size. The Young modulus of the films is always close to the bulk material value showing all the films are porosity free.

Keywords
Sputtering
DOMS
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Chromium