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Phase tailoring of Ta thin films by HiPIMS in Deep Oscillations Magnetron Sputtering (DOMS) mode.

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Ta is a refractory metal with a high melting point, a low electrical resistivity, and an excellent chemical inertness at temperatures below 150 °C. Due to this characteristics has many applications, for instance in magnetic thin film applications, as-diffusion barriers in integrated circuits and magnetic disk drives. In bulk form, Ta has the α-phase. However, during thin film growth of Ta, the metastable tetragonal β-phase commonly forms. It has been shown that energetic ion bombardment of both the substrate and the growing film can strongly influence the film structure and properties. However, theformation of the β-phase is not fully understood. The main objective of this work is to understand the mechanisms responsible for Ta phase formation by using an ionized Ta flux during deposition. Ta films were deposited by deep oscillation magnetron sputtering (DOMS), a variant of high power impulse magnetron sputtering (HIPIMS). The directionality and the energy of the depositing species was controlled by changing the ionization fraction of the Ta species arriving at the substrate at different deposition pressures and substrate biases. In this work, the surface morphology (AFM), microstructure (SEM), structure (XRD) and mechanical properties (Hardness and Young's modulus) of the films were characterized.

Keywords
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