Influence of Ta seed layer on the magnetic and structural parameters of CoFeB/MgO stack

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Magnetic tunnel junctions with ultrathin CoFeB electrodes and MgO spacer can exhibit perpendicular magnetic anisotropy (PMA) and high tunnel magnetoresistance. However, buffer layers cay strongly affect the magnetic and structural properties of such multilayers. The CoFeB/MgO stacks deposited on a Ta seed buffer layer of different thicknesses (5, 10 and 15 nm) are investigated. The crystallization phases of tantalum, the topological roughness of the interfaces and the effective magnetic dead layer between Ta and CoFeB layers are examined to optimize the thickness of the seed buffer. While thin Ta layer is relatively smooth, a thick magnetic dead layer is observed due to easy interdiffusion into the amorphous buffer. A thick Ta buffer act as a better diffusion barrier, however, its large crystallites cause higher topological roughness. STEM images and measurements of magnetic properties as a function of temperature provide more insight into the formation of the Ta/CoFeB interface and the paramagnetic dead layer.