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Optimizing magnetic anisotropy and tunnel magnetoresistance in $CoFe_2O_4$/MgO bilayers through SHI processing

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Magnetic tunnel junctions (MTJs) formed by CoFeB and MgO are key components to form memory elements in magnetic random access memory (MRAM) for high-density data storage applications. A thorough understanding of the relation between properties such as magnetic anisotropy (MA) and tunnel magnetoresistance (TMR) is crucial for optimizing the performance of these devices. *These properties have been seen to improve by the effects of Swift heavy ion (SHI) irradiation through improved structural and interfacial electronic effects,***. This study investigates the effects of Swift heavy ion (SHI) irradiation on magnetic anisotropy and tunnel magnetoresistance properties of CoFe2O4/MgO magnetic bilayer. The results show SHI irradiated thin films have enhanced magnetic anisotropy and transport properties of the thin film. The study also suggests an inverse relation between the two properties, which will be important in making MTJs with high magnetic anisotropy and TMR. This contribution in understanding the enhancement of magnetic and transport properties by SHI irradiation on MTJ is critical in advancing MTJ technology for spintronic applications.

Footnotes

- Lou, K., et al., (2022). Perpendicular magnetic anisotropy in as-deposited CoFeB/MgO thin films. Applied Physics Letters, 121(12). ** Yang, C. Y, et al.. (2015). Competing anisotropy-tunneling correlation of the CoFeB/MgO perpendicular magnetic tunnel junction: An electronic approach. Scientific reports, 5(1), 17169. *** Garg, S., et al., (2023). Dissolution of Mg(OH)2 by swift heavy ion irradiation in CoFe2O4/MgO/ZnFe2O4 multilayer thin films. Materials Letters, 349, 134738.

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