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Oxygen-enable control of Dzyaloshinskii-Moriya Interaction in Fe/Ir(001) bilayers ABDERREZAK BELABBES, King Abdullah Univ, GUSTAV BIHLMAYER, STEFAN BLÜGEL, Peter Grünberg Institut and Institute for Advanced Simulation, D-52425 Jülich, Germany, AURELIEN MANCHON, King Abdullah Univ — Using relativistic first principles calculations, we demonstrate that the magnitude and sign of the Dzyaloshinskii-Moriya inter action(DMI) of Fe/Ir(001) interface can be controlled by tuning the coverage of the oxygen capping layer, which changes the spin-wave length and the depth of the energy minimum. In addition, we explain how the magnetic interactions [Exchange inter action, DMI, and the magnetocrystalline anisotropy (MAE)]at such transition metal interface are modified in the presence of Oxygen, which might prevent any stable magnetic order due to the small energy scale. We observe a change sign of the DMI when the coverage exceeds 50%. In particular, we found that due to the C4 breaking symmetry and the large spin-orbit interaction of the Ir substrate the DMI exceeds a critical strength and competes with the exchange interaction and causes homochiral magnetic structures. This study reveals that in realistic systems capped by an oxide, such as HM/F/MOx (HM is a heavy metal, F a ferromagnet an MOx=MgOx, CoOx, TaOx etc., the DMI can be tuned by changing the oxidation conditions of the capping layer, offering a convenient way to control it. Therefore, understanding of the these phenomena may have impact in the context of facilitating applications in spintronics.

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