Interfacial enhancement of out-of-plane torque in RuO2

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Altermagnets are compensated collinear antiferromagnets that host time-reversal symmetry breaking phenomena. Among them, the spin splitting effect that induces a spin splitting torque with spin polarization parallel to the Néel vector has attracted extensive attention. Recently, an out-of-plane spin-orbital torque (SOT) due to the spin splitting effect has been reported in (101) oriented RuO2, however, its altermagnetic property is still on debate. Here, we report an interfacial enhancement of out-of-plane SOT in RuO2, which can enable field-free magnetization switching of a perpendicularly magnetized layer on the (101) oriented RuO2. We find that the out-of-plane SOT can be significantly enhanced when a thin heavy metal, e.g. Pt, layer is inserted between the RuO2 and the ferromagnetic layer. The enhancement of out-of-plane SOT may arise from the out-of-plane term of Néel vector due to the appearing of net magnetization between the RuO2 and Pt layers, which has been confirmed by the technique of polarized neutron reflectometry. The finding of interfacial enhancement of out-of-plane torques offers a promising approach to develop altermagnetic devices for future spintronic applications.