

中國工程師學會學生論文競賽摘要投稿範本 (16 號標楷體)

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摘要

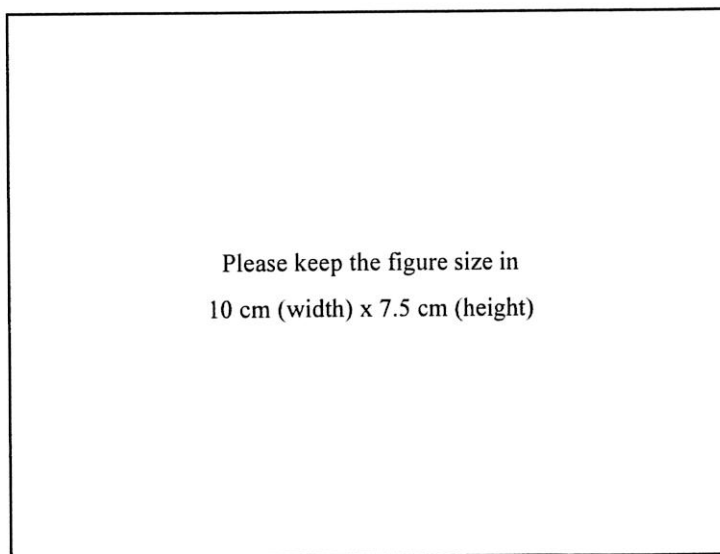
論文撰寫中英文皆可，請選用標楷體之中文字型及 Times New Roman 之英文字型，並附註論文研究重點數據(圖)一張，含圖註解去重點呈現本篇論文的研究成果。整篇以一頁 A4 為限。

關鍵詞：以不超過六個為原則。

Abstract

The abstract can be written in either Chinese or English (in Times New Roman style). Additionally, please include one representative figure relevant to the work to highlight the results, along with an appropriate caption. Please keep the submitted file within one page.

Keywords: No more than six.



圖、請附註一個詳細的圖解，若有多個圖，最好用一圖組來表示，並請標註(a) (b) (c) (d)...

Fig. Please give a concise caption for the provided figure. For a figure set, please label (a) (b) (c) (d)... in sequence if needed.

(範本)

Spin–Orbit Torque Booster in an Antiferromagnet via Facilitating a Global Antiferromagnetic Order: A Route toward an Energy-Efficient Memory

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Abstract

Spin transport and the associated spin torque effects in antiferromagnets (AFMs) are scientifically interesting but have remained elusive due to the varied observations of spin transport in AFMs. This study revisits the role of a global Néel order in nickel oxide (NiO) facilitated through a spin–orbit torque (SOT) and examines the enhanced SOT efficiency in a heavy metal (W)/AFM (NiO)/ferromagnet (FM, CoFeB) trilayer with varying NiO thicknesses ranging from 1 to 5 nm. At the as-grown state, the Néel order of NiO is randomly oriented due to the polycrystalline nature of the film structure, leading to increased spin absorption and blocking spin transport from the adjacent W layer. When the spin current amplitude exceeds a threshold value, SOT enables reorientation of the Néel order in NiO to an equilibrium state, forming a global Néel order aligned with the applied current. This long-range Néel order reduces spin absorption and enhances spin transport through NiO, hence boosting the SOT efficiency in the adjacent CoFeB layer. X-ray magnetic linear dichroism spectroscopy and rewritable Néel order reorientation experiments in a device with orthogonal geometry confirmed the strong correlation between the global Néel order facilitation and the boosted SOT efficiency, which is enhanced larger than 4-fold for both damping- and field-like torques in the trilayer with 5 nm NiO. This study not only reveals the strong correlation between globally facilitated Néel order and spin transport in NiO but also offers a promising manner to promote AFM-based SOT devices toward energy-efficient computing technology.

Keywords: Antiferromagnet, Néel order, Spin-orbit torque, X-ray magnetic linear dichroism, Magnon, Easy-plane

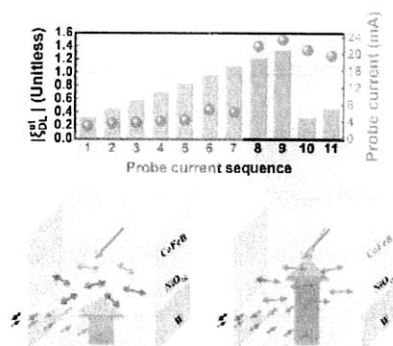


Fig. This work reports a spin-orbit torque (SOT) booster in antiferromagnet functioning to promote the spin conductivity and enhance SOT efficiency to meet the requirement of energy-efficient technology.

*This work is cited from H. K. Chang et al., *ACS Appl. Mater. & Interfaces* **16**, 65037–65045 (2024).