Skyrmion nucleation on a surface of topological insulators

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Skyrmion nucleation induced by spin-transfer torques at an interface of a topological insulator and a ferromagnetic insulator is investigated. Due to strong spin-orbit coupling on a surface of topological insulators, which enhances the effect of spin torques, efficient manipulation of skyrmions is expected and therefore, topological insulators could provide the ideal platform to achieve high-performance skyrmionic devices. Using micromagnetic simulations and energetics, we evaluate properties of the skyrmion nucleation on a surface of topological insulators, such as nucleation time, critical electric field, and skyrmion numbers [1]. We show that the nucleation time is inversely proportional to the applied electric field. We also identify the Gilbert damping and temperature dependences of the critical field. Furthermore, we analytically evaluate the effect of the Dzyaloshinskii-Moriya interaction and demonstrate that the temperature dependence can be explained by the reduction of a magnon excitation gap due to the self-energy corrections.

[1] D. Kurebayashi and O. A. Tretiakov, *arXiv:2112.12967* (2021).