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Irreversible Thermodynamics of Uniform Ferromagnets with Spin Accumulation: Bulk and Interface Phenomena WAYNE SASLOW, Texas A&M Univ, FUXIANG LI, Los Alamos National Laboratory, TOMOHIRO TANIGUCHI, National Institute of Advanced Industrial Science and Technology (AIST), Spintronics Research Center — We extend the irreversible thermodynamics of uniform ferromagnets to include the non-equilibrium phenomenon of spin accumulation, both for conductors and for insulators. The dynamics of the quantization axis $\hat{M}$ is governed by the Landau-Lifshitz equation. The spin accumulation, whose longitudinal and transverse parts we label δM and $\vec{m}$, is due to a non-equilibrium distribution of magnetic excitations. Its dynamics is governed by a Bloch equation that includes spin diffusion. We also consider transport across surfaces, including boundary conditions for $\hat{M}$, δM, and $\vec{m}$, and apply the results to the nature of the reciprocity between spin transfer torque and spin pumping.

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