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Spin Hall Effect and Irreversible Thermodynamics; Center-to-Edge Transverse Current-Induced Voltage WAYNE SASLOW[1], Texas A&M University — For the first time the Dyakonov and Perel theory of the Spin Hall Effect (SHE) is examined from the viewpoint of irreversible thermodynamics, which is significantly more constraining than the symmetry arguments of pure phenomenology. As thermodynamic driving forces we include the thermal gradient, the gradient of the electrochemical potential (rather than the potential gradient and density gradient separately), and the "internal" magnetic field that is thermodynamically conjugate to the magnetization. In turn, we obtain the form of bulk transport coefficients relating the fluxes to the thermodynamic forces. Relative to Dyakonov and Perel, in addition to the new terms due to thermal gradients, the Onsager relations require three new (non-linear) terms in the current density, and minor revisions in the current density and spin current density. For a longitudinal current along a strip, the center-to-edge transverse voltage difference, due both to the $-\beta\vec{P}\times\vec{E}$ term of the number current density $\vec{q}$ and to one of the new current density terms, is determined. An ac capacitative probe likely would not significantly disturb this effect. We estimate a $\Delta V_{\perp}$ as large as 10^{-4} V for GaAs, but only 10^{-8} V for Pt.

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