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Intrinsic spin-Hall effect in the presence of an in-plane magnetic field[1] LUYAO WANG, CHONSAAR CHU, National Chaio Tung University, ANATOLY MALSHUKOV, Russian Academy of Sciences, Institute of Spectroscopy —
The intrinsic spin-Hall effect (SHE) induced by a driving electric field E_x in the presence of an in-plane magnetic field $\vec{B}$ in a 2D semiconductor strip is studied. In the diffusive regime, the spatial distribution of spin densities S_i (i=x, y ,z) is calculated from a spin diffusion equation derived from nonequilibrium Green's function. For the case of Rashba spin-orbit interaction (SOI), we find that the spin polarization S_z normal to the 2D strip remains zero with or without the in-plane magnetic field. For the case of Dresselhaus SOI, where cubic term is included, the symmetry of S_z with respect to the in-plane magnetic field depends on the orientation of the $\vec{B}$ field. With $\vec{B}$ along $\hat{x}$, S_z exhibits symmetric dependence on $B\hat{x}$. However, with a transverse in-plane magnetic field, along $\hat{y}$, at the edge of the strip exhibits asymmetric dependence on $B\hat{y}$. These results lead to a possible diagnostic tool for the identification of the SOI in the system.

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