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Modeling of diffusion of injected electron spins in spin-orbit coupled microchannels LIVIU P. ZÂRBO, Institute of Physics ASCR, CZ, JAIRO SINOVA, Texas A & M University, USA, I. KNEZEVIC, University of Wisconsin-Madison, USA, J. WUNDERLICH, Hitachi Cambridge Laboratory, UK, T. JUNGWIRTH, Institute of Physics ASCR, CZ — Understanding of the collective electron spin dynamics under the influence of spin-orbit fields is a key requirement in the quest for all-electrical semiconductor spintronic devices. We investigate the spin dynamics of an ensemble of spin polarized electrons injected in the diffusive microchannel of a model device with linear Rashba and Dresselhaus spin-orbit coupling. Using a spin-dependent ensemble Monte Carlo method, we analyze the steady state spin density patterns dependence on channel dimension and orientation, spin-orbit coupling strengths and external magnetic fields. We show that in the persistent spin helix regime, the spin density patterns depend only on the system geometry and channel orientation. Magnetic fields of order of tesla are required to affect spin dynamics in the persistent spin helix regime. Our simulation results [PRB 82, 205320 (2010)] have been used to help understand the spin diffusion in the channel of the recently demonstrated spin Hall effect transistor [arXiv:1008.2844].

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