Quantitative analysis of Spin hall effect in nanostructures

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Spin transport in nano structured devices depends on interface resistance, electrode resistance, spin polarization and spin diffusion length. Spin Hall Effect (SHE), caused by spin-orbit scattering in nonmagnetic conductors gives rise to the conversion between spin and charge currents in a nonlocal device. Recently, SHE has been observed using nonlocal spin injection in metal-based nanostructured devices[1], which paves the way for future spin electronic applications. In present work we have developed a theoretical model to explain the SHE phenomena based on experimental results obtained till date. We focus on the comparative study of the above fact based on DC spin Hall effect, Effects of epitaxial strain and AC spin Hall effect. we have defined the model equations to describe the charge and spin transport in nanostructures using the Spin diffusion length λ_F, spin relaxation time τ_{SF} and diffusion constant D as the characteristic parameters. The electrical current density is calculated using the fundamental equation based on equilibrium carrier density n_σ with spin σ.

[1]S. Takahashi1 and S. Maekawa, Sci. Technol. Adv. Mater. **9**, 014105 (2008).