Magnetic Tunnel Junctions for spintronics applications

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High density spin-polarized current passed through MTJ nanopillar can affect the local magnetization using the Spin Transfer Torque (STT) effect. This effect can induce either precession of magnetization (microwave ST-oscillator) or switch the magnetization of the free layer (STT-RAM). The STT-RAM cell is characterized by low power consumption and better thermal scalability in comparison to conventional MRAM. Crucial issues of STT in MTJs are a reduction of the critical current density that is able to switch the magnetization, which is possible for example by using interfacial perpendicular anisotropy of ferromagnetic electrodes or optimizing the thickness of MgO tunnel barrier. The application of RF current to MTJ generate DC voltage across the device, when the frequency is in resonance with resistance oscillations (spin diode effect), arising from the ST. Such spin torque ferromagnetic resonance (ST-FMR) excitation in a MTJ nanopillar, as well as an inverse effect, i.e., generation of the RF signal, provide potential application in the telecommunications technology. In addition, the dynamics of MTJs, controlled by electric field will be also discussed in this presentation.

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