RESISTANCE OF DOMAIN WALLS INDUCED BY SPATIAL MODULATION OF EXCHANGE BIAS AND SURFACE ROUGHNESS

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We present two different approaches that can be used to artificially induce domain walls in a thin ferromagnetic film and to determine the corresponding intrinsic domain wall resistance (DWR). In a first approach, we induce domain walls in ferromagnetic Co and Fe films by bringing the Co and Fe in contact with an antiferromagnetic CoO film that is patterned into micrometer wide parallel lines to create a spatially modulated exchange bias coupling. This causes a local enhancement of the coercive field and allows us to achieve a periodic domain configuration with 180° Néel walls. The intrinsic DWR can be determined by using rotating magnetic fields that result in a reversible creation and annihilation of the Néel walls. For Co as well as for Fe the intrinsic DWR is positive and in agreement with models that are based on the giant magnetoresistance effect. In a second approach, a periodic configuration with 180° Néel walls can be created due to the spatial modulation of the roughness of an Fe film. This is achieved by depositing the Fe on top of a pattern consisting of micrometer wide parallel rough Ag lines, resulting in a local enhancement of the coercive field. In this case the determination of the intrinsic DWR becomes complicated by non-perfect anti-parallel alignment of the magnetization and uncontrolled formation of additional domain walls at submicrometer scale.