The superlattice rotational-anisotropy counterpart to a polycrystalline exchange-biased material

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The idea of a rotational anisotropy was introduced by Stiles and McMichael [1, 2] for polycrystalline exchange biased samples. They observed that some of the AFM grains are sensitive to the unidirectional field, while others are not. They measured an isotropic shift of the spin wave frequencies in all directions in the ferromagnetic resonance (FMR) experiments decreasing or increasing external magnetic field in order to get resonance of a magnetic moment precession. However, in the case of epitaxial samples, which reveals the exchange-bias, we should expect similar effects. Importantly, these effects should be sensed by Brillouin light scattering (BLS) method, which belongs to the perturbative measurements similarly to the FMR technique. The results from BLS experiments in several superlattices are reported. The epitaxial results counterpart the Stiles and McMichael rotatable anisotropy approach, as both methods sensed irreversible effects of domain-wall hysteresis in the antiferromagnetic layer. Thus, in the polycrystalline samples rotated through macroscopic angles some reversibly formed domain walls gave rise to exchange bias while the other parts of the antiferromagnetic domain structure changes irreversibly became all-rotational angles independent. In the epitaxial samples with strictly defined crystallographic symmetries at room temperatures, the all-rotational angles behavior after field cooling was tailored by different types of magnetocrystalline symmetries, especially by the unidirectional anisotropy field.

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[1] R.D. McMichael, M.D. Stiles, P.J. Chen, and W.F. Egelhoff Jr, Phys. Rev. B **58** (1998) 8605.
[2] M.D. Stiles and R.D. McMichael, Phys. Rev. B **59** (1999) 3722.

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