MAGNETIC PROPERTIES OF ATOMIC LAYER DEPOSITED MULTILAYER THIN SOLID FILMS

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Research devoted to the achievement of multiferroic thin films is active due to prospective applications as these materials would be useful as components of non-volatile memory and electromagnetic sensor devices. On the other hand, the task of depositing multiferroic thin films has appeared to be quite challenging and intensely ongoing. In relation to this, Fe_2O_3-BiOCl composites [1], and Co_3O_4-ZrO_2 [2], ZrO_2-Al_2O_3 [3] and HfO_2-Al_2O_3 [4] nanolaminates were deposited and characterized in this study. The main focus was on studying the magnetic properties of these structures in their as-deposited states. Selected multilayer structures with their thicknesses and measured magnetic coercivity values are presented in Table **I**. The deposited structures demonstrated ferromagnetic-like behaviour at room temperature, and ε-Fe_2O_3 containing specimens exhibited several times higher coercivity (reaching up to ~10 kOe) compared to other samples. The stabilization of metastable phases induced magnetization in nanolaminates containing ZrO_2 and HfO_2, which are oxides not known for their magnetic properties in their stable forms.

*Table **I**. Multilayer structure description (number in front of the compound indicates the number of ALD cycles), their total thicknesses and measured coercivity values*

Type of study	ALD structure description	Total thickness (nm)	Coercivity (Oe)
Fe_2O_3-BiOCl composites [1]	175 × Fe_2O_3 + 280 × BiOCl	50	9757
	80 × Fe_2O_3 + 280 × BiOCl	33	4230
Co_3O_4-ZrO_2 [2]	2 × [200 × Co_3O_4 + 100 × ZrO_2] + 200 × Co_3O_4	64	32
	2 × [100 × ZrO_2 + 200 × Co_3O_4] + 100 × ZrO_2	60	21
ZrO_2-Al_2O_3 [3]	5 × [120 × ZrO_2 + 6 ×Al_2O_3] + 120 × ZrO_2	38	85
HfO_2-Al_2O_3 [4]	3 × [200 × HfO_2 + 10 × Al_2O_3] + 200 × HfO_2	48	127

References

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