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X-ray study of nanosized multilayer heterosturctures

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X-ray methods for diagonostic of nanosized heterostructures are long proved reliable instrument for analysis of real structure of multilayer heterocompositions and determination of parameters for single layers and interfaces.
In given work we used high-resolution x-ray diffraction and x-ray reflectivity methods for the analysis of spintronic maultilayer heterosystems. Spintronic is a new technological approach based on management of spin degrees of freedom in solid structures. Semiconductor spintronic systems which are the basis for the creation of spin transistors allow to manage spin currents. It is also important to mention that traditional electronic systems based on electric charge transfer have high power consumption and heat generation while in the semiconductor spintronic systems heat dissipation is minimal. X-ray diffraction rocking curves and x-ray reflectivity curves measurements were held in laboratory x-ray equipment of Kurchatov complex of NBICS technologies.
Joint analysis of x-ray diffraction and reflectivity data from semiconductor magnetic 2D structures with quantum dots GaAs/δ-Mn/InGaAs/GaAs allowed to determine structural parameters of all layers including very thin δ-layers of Mn and these of interfaces. The were established layers parameters of magnetic impurity allowed to find interrelation between structure of the samples with their magnetic and transport properties.
For the metallic superlattices Fe/Cr/Gd/Cr on Si substrates there were determined parameters of layers inside the superlattice period and interfaces between them. It allows to clarify real structural parameters of given heterocomposition and explain some peculiarities on their magnetic properties.
Such complementary approach for study of spintronic heterosystems like cap-layer/EuO/Si allowed to analyze modification of structural parameters on interfaces. As a result of study it was established that at the average thickness of interface ˜25 Å the transfer from strained lattice EuO to a fully relaxed one takes place.
Joint analysis of x-ray methods data allows to analyze real structure including all of it peculiarities for different objects. In combination with data from other methods it gives the opportunity to establish interconnection between the structure of nanosized heterosystems and their electrophysical, magneto-trasport and other properties.

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