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Development of design and technological methods for creating integrated digital magnetic sensors of threshold type with a nanoscale modified Al_2O_3 layer controlled by an electric field

Type of collaboration

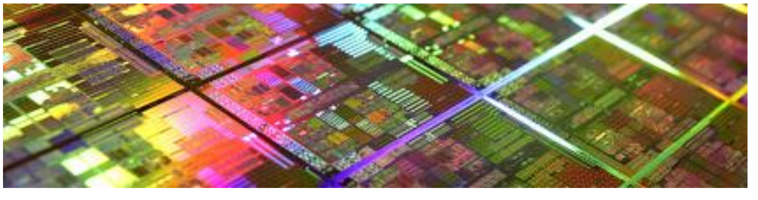
research cooperation / technical cooperation

Key words

sensor, microelectronics, magnetic, threshold, nanotechnologies

State of IPR

Secret know-how



Project key goals:

- Research on the influence of the magnetic field and resistive switching in a nanoscale Al_2O_3 structure.
- Study of the electronic properties (activation energy and density of local electronic states) of anodic aluminum oxide doped with carbon-containing inclusions.
- Determination of threshold characteristics and the influence of an external magnetic field.
- Obtaining nanoscale magnetosensitive Al_2O_3 structures of threshold type for creating digital magnetic sensors.

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Theoretical base:

Nanoscale Al_2O_3 structures with quantum wells are a promising material for creating digital integrated magnetic sensors of threshold type. Such components meet all the requirements for the electronic element base for use in science and technology.

The principle of operation of the developed digital magnetic sensors of threshold type is based on the excitation of electrons located on traps in a potential well by a magnetic field. Filling electron traps in a thin dielectric layer decreases the resistance of such a layer. In turn, once the magnetic field reaches a threshold value, when the electrons acquire enough energy to leave the electron traps, the resistance of such a dielectric layer increases dramatically. The application of an electric field increases the energy of the electrons on the electron traps and thus allows you to adjust the depth of the potential well or the threshold value for the magnetic field at which the electrons leave the potential well.

Integrated components of magnetic sensors are currently considered as one of the most promising methods for creating a new generation of non-volatile sensors. Such components meet all the requirements for the element base of microelectronics for use in advanced information technologies. The main advantages of such components are extremely low energy consumption, high speed of writing, erasing and reading information, and the possibility of using them in neuromorphic systems. The magnetic sensor components use a multi-layer "metal-nanoscale metal oxide-metal" structure and are characterized by the capability to scale, long data retention time, and can meet the criteria of high integration density.

Sensor application areas:

battery-powered positioning devices; door-opening radio sensors; electric meter body opening sensor; medical devices; Internet of Things devices; solenoid position detection.