Designed synthesis of materials for high-sensitivity geomagnetic sensors

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Abstract: A structure of Ta/MgO/NiFe/MgO/Ta was designed and synthesized, which combines the advantages of both tunnel magnetoresistance materials with high magnetic field sensitivity and anisotropic magnetoresistance materials with high directional sensitivity. The magnetoresistance ratio in the device with structure of Ta(5)/MgO(4)/NiFe(10)/MgO(3)/Ta(3) (thicknesses in nanometers) increases with an increase in annealing temperature, reaching a maximum value of 3.5% at 450°C, and then decreases with a further increase in annealing temperature. Meanwhile, a high sensitivity of 2.1%/Oe is obtained. The higher magnetoresistance ratio and sensitivity come from the significant specular reflection of electrons at both interfaces due to the crystalline MgO layer together with the sharp interfaces with the NiFe layer. © 2010 American Institute of Physics.

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