Large spin-dependent tunneling magnetoresistance in Fe3O4/PET heterostructures developed at room temperature: A promising candidate for flexible and wearable spintronics

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ABSTRACT

Half-metallic nanocrystalline magnetite (Fe_3O_4) thin films, with different thicknesses were developed on polyethylene-terephthalate (PET) substrates, by reactive sputtering at room temperature. Fe_3O_4 film (200-nm thick)/PET heterostructures possess superior electrical and magnetic characteristics, with a Verwey transition temperature (T_v) of ~122 K and a saturation magnetization (M_s) ~ 361 emu/cm^3. Furthermore, the antiferromagnetic (AFM)-coupled antiphase boundaries (APBs) controlled the transport properties of the Fe_3O_4 thin films, due to the tunneling of spin-polarized electrons through the films. Very-high magnetoresistance (MR) value (−8.9%) were observed for HFilm plane, constructed from Fe_3O_4 (200-nm thick)/PET when H values were below 60 kOe at 300 K. In addition, flexibility tests, to examine resistivity, M-H and MR, were performed using with 90° and 45° bent angles and cyclability experiments were implemented to validate the reproducibility of these characteristics. These outcomes demonstrated that Fe_3O_4/PET heterostructures may represent a promising candidate for flexible/wearable spintronics.

KEYWORDS: Fe3O4/PET heterostructure; Saturation magnetization; Magnetoresistance; Verwey transition; Flexible spintronics

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