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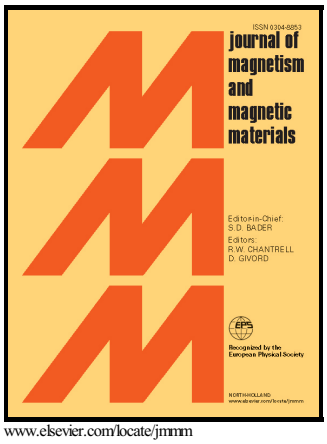

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MAGNETORESISTIVE MEMORY WITH RECORDING BY ELECTRIC FIELD: IS THE WEAK FERROMAGNETISM NECESSARY?

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ABSTRACT

Possible approaches to creating a magnetoresistive memory with recording by electric field (MERAM) are considered. The memory based on a particular geometry of multiferroic $BiFeO_3$ is shown to be the most promising. The relatively small values of the weak ferromagnetic moment and linear magnetoelectric coupling constant in $BiFeO_3$ are not significant obstructions for creation of such a MERAM. The key factors are the coupling between electrical polarization and the antiferromagnetism vector in the multiferroic (not between polarization and magnetization vectors), as well as the exchange coupling between the antiferromagnetism vector and the ferromagnet layer magnetization caused by the spin-flop orientation of the latter two vectors at the interface. This is inherently an antiferromagnetic-ferroelectric device mechanism.

KEYWORDS: magnetoresistive memory, recording by electric field, multiferroic, $BiFeO_3$, antiferromagnet, exchange coupling, ferromagnet, spin-flop orientation.

1. INTRODUCTION

One of the most promising directions of spintronics is related to creation of a magnetoresistive memory with recording function carried out by the electric field (MERAM). The majority of developments in this direction can be divided into two large groups, with respect to the interaction between one of the ferromagnetic layers of the magnetic tunnel junction (MTJ) and the layer sensitive to the action of an electric field (Fig. 1). The main feature of the first group is an artificially fabricated superlattice consisting of a sandwich of