GEMaC
Groupe d'Étude
de la Matière Condensée

ADDITIONAL FUNCTIONALITY IN A MATERIAL WITH A THOUSAND APPLICATIONS

Bismuth iron garnet, a material with already remarkable properties, becomes conductive with adjustable resistivity.

Garnets A3B5O12 possess a multitude of properties that are interesting for modern electronics. Among the materials crystallizing in this structure, the bismuth iron garnet Bi3Fe5O12 (BIG) is truly exceptional, as it combines significant magnetization, high magnetic order temperature and outstanding magneto-optical response with magneto-electric coupling.

In the search for a simultaneously magnetic and conductive oxide, we used insulating BIG as a matrix for doping with aliovalent cations. There is no bulk reference for completely bismuth-substituted iron garnet, and the synthesis of BIG in thin film form is non-trivial. In GEMaC, we have succeeded in making conductive BIG thin films and have achieved a resistivity change of 10 orders of magnitude with respect to the reference compound, using doping and oxygen off-stoichiometry. In a joint PhD thesis between the FOX team of GEMaC and the STEM group of the Laboratoire de Physique des Solides in Orsay, we demonstrated the atmosphere-induced reversibility of this resistivity change and evidenced its microscopic origins. These results highlight the possibility of integrating n-type and p-type doped BIG films in spintronic structures as well as their potential use in gas sensing applications.

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Read more:

Adrien Teurtrie, Elena Popova, Ibrahim Koita, Ekaterine Chikoidze, Niels Keller, Alexandre Gloter, and Laura Bocher,
"Atmosphere-Induced Reversible Resistivity Changes in Ca/Y-Doped Bismuth Iron Garnet Thin Films"
Adv. Funct. Mater. 29(46), 1904958 (2019)