NAPLES, ITALY 23-27 JUNE
DSL2025 NAPLES
21st International Conference on Diffusion in Solids and Liquids

ABSTRACT

Incommensurate Modulations in Bi-containing Perovskite Multiferroics

A.N. Salak[1], D.D. Khalyavin[2]

[1]CICECO-Aveiro Institute of Materials, University of Aveiro, 3810-193, Portugal
[2]ISIS Facility, Rutherford Appleton Laboratory, Didcot, OX11 0QX, UK.

Bi-containing perovskite materials exhibit a variety of structural phases with interesting properties and improved functionalities. The electronic degree of freedom related to the lone pair nature of Bi^{3+} usually results in polar/antipolar atomic displacements in these materials. The displacements are often coupled to oxygen octahedral tilting. Both types of distortions define the symmetry of the perovskite lattice and control electric and magnetic properties as well as a cross-coupling between them.

Incommensurate modulations of crystal structure are caused by competing interactions. Coexistence the ferroelectric soft mode and the ferrodistortive tilts of the oxygen octahedra in $Bi_{0.8}La_{0.2}Fe_{0.5}Sc_{0.5}O_3$ induces incommensurate displacements of bismuth and oxygen along one of the pseudocubic direction combined with antiphase octahedral tilting about this axis [1]. A helical modulation of the Bi displacements in $BiCu_{0.1}Mn_{6.9}O_{12}$ is a result of fine competition between electronic instabilities caused by the lone-pair electron degree of freedom of Bi^{3+} and degenerate e_g electron orbitals of octahedrally coordinated Mn^{3+} [2].

Possible ways to control incommensurate modulations in Bi-containing perovskites with external electric filed, their effect on magnetic ordering and likely applications are discussed.

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