Tokumoto LAB.
[Structure and Properties of Lattice Defects]

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◆Topological insulator
Topological insulators are quantum materials that have a bulk band gap as an ordinary insulator but have protected metallic conducting states on their edge/surface. Topological insulators were first predicted in 2005, and have been experimentally verified in 2007.

Metallic edge/surface states
- helically spin-polarized
- massless Dirac fermions
- robust against nonmagnetic disorder

◆Dislocations in topological insulators
In 2009, it has been theoretically predicted that the metallic states also occur along dislocations in 3D topological insulators.

◆Enhancing bulk insulation of topological insulators
One of the most urgent tasks in the field of topological insulators is to achieve a bulk-insulating state, which is a prerequisite for the study of characteristic surface or dislocation transport phenomena.

Optimizing composition of Pb(Bi$_x$Sb$_y$)$_4$Te$_4$ topological insulator to achieve a bulk-insulating state

Direct observation of Te/Se ordering, which is a key structure to achieve lower bulk conduction, in Pb(Bi$_x$Sb$_y$)$_4$Te$_4$Se$_4$ topological insulator.