Phys. Status Solidi – Best of 2013

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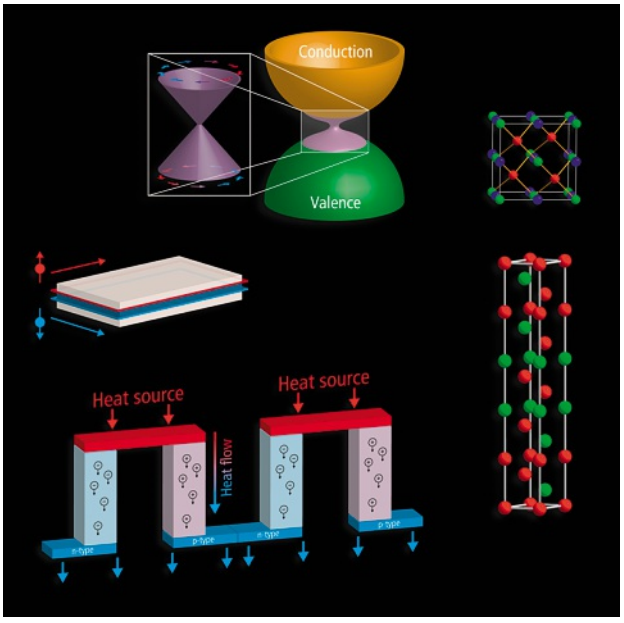
FRONT COVER

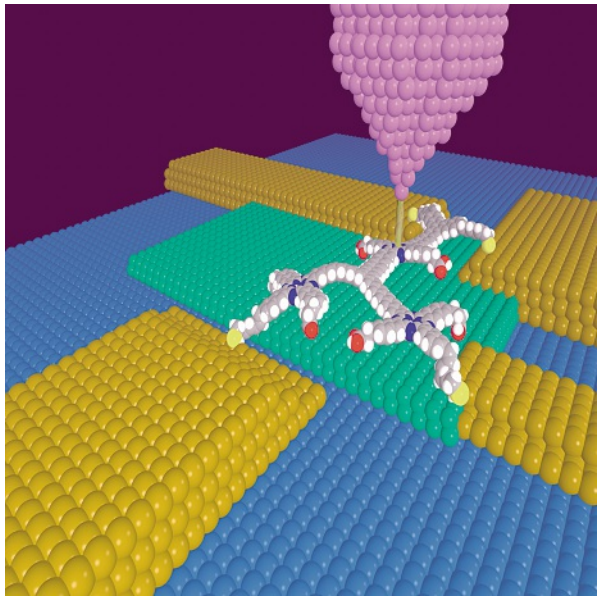


Topological insulators (TIs) are a recently discovered new quantum state of matter. They have gapless surface states inside a bulk energy gap, which are protected from non-magnetic perturbations by the topology of the electronic structure. Starting with the discovery of two-dimensional TIs, HgTe-based quantum wells, many new topological materials have been theoretically predicted and observed experimentally. Currently known TI materials can possibly be classified into two families: compounds that derive from the cubic HgTe family and compounds that are similar to the layered Bi_2Se_3 family. The signatures found in the electronic structure of a TI also cause these materials to be excellent thermoelectric materials, such as narrow band gaps and heavy constituents. On the other hand, excellent thermoelectric materials can be also topologically trivial, such as PbTe. In their Review@RRL article, Müchler et al. (see pp. S11–S20 here) present a short introduction to topological insulators and thermoelectric materials, and give examples of compound classes where both good thermoelectric properties and topological insulators can be found and how their properties correlate.

The Review@RRL article by Müchler et al. is part of the Focus Issue on Topological Insulators – From Materials Design to Reality published in February 2013 (Guest Editors: Claudia Felser, Shoucheng Zhang, and Binghai Yan)

BACK COVER

The request for ongoing development of electronic devices stimulates alternative technology research. In this regard, a very promising candidate is the concept of single-molecule electronics based on the state-of-the-art use of modern nanotechnology. On the cover, the concept of a single-molecule electronic device is envisaged. The molecule is designed to perform a given logic task, and is thus equipped with various functional groups responsible for task implementation. Furthermore, it possesses anchoring groups that bind the molecular processor to an underlying surface and metallic nanoelectrodes without severe distortion of its internal structure, i.e. with no alteration to its operation. Below the processor there is an ultrathin buffer layer that decouples it from a (semi-)conducting substrate. The scanning tip is used either for characterisation of the device or for initiating/controlling its operation. The Feature Article by Prauzner-Bechcicki et al. (see pp. S53–S63 here) presents a review of recent experiments proving significant progress in single-molecule computing device technology.



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