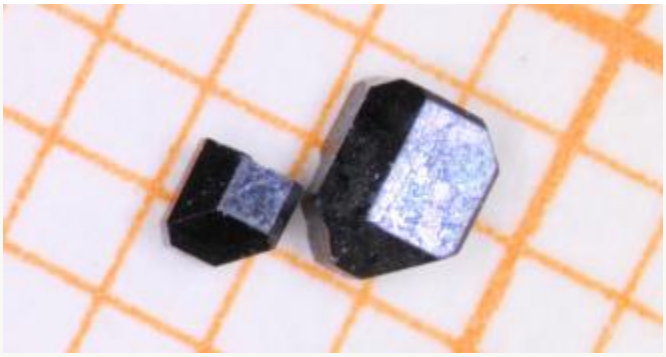
SAMARIUM HEXABORIDE

There is a lot of buzz in the physics community about a new topological insulator: samarium hexaboride, SmB_6. The reason why any major discovery about topological insulators seems to be big news is that these materials have some unique electrical characteristics that make them not only very interesting from a fundamental point of view but also for electronic applications.

Topological insulators are electrically insulating in their interior, but at the surface they do conduct current. Moreover, the surface currents are topologically protected (hence the name), which means that the electrons that carry those currents don't veer off the track easily and maintain their properties over long distance. Although a number of topological insulator compounds are known, the problem so far has been that it has been difficult to fabricate these with sufficient purity such that the interior was indeed insulating. This has been a problem, as the electrical current inside the materials just overwhelms the surface properties.



Samples of samarium hexaboride crystals. (c) Johnpierre Paglione, reprinted by permission from Macmillan Publishers Ltd. Nature 492, 165 (2012) doi:10.1038/492165a.

Not so in samarium hexaboride. A number of papers put on the arXiv preprint server by Zachary Fisk and colleagues from the University of California at Irvine and the University of Maryland have now shown that this material could have all the desired properties of a topological insulators. It is insulating in the interior, but on the surface it shows very good conductivity. Indeed, at low temperatures the crystals, several millimetres in size, show very high surface mobilities of 72,000 cm^2/Vs.

So far, however, many of the actual properties that make topological insulators so unique haven't been demonstrated yet. And of course, none of the papers has appears to have been published in a peer-reviewed journal yet. But they certainly have made headlines already. The first of the three arxiv papers referenced below was placed on arXiv on November 21st. On the 24th Ross McKenzie wrote about it in Condensed Concepts, which is from where I heard first about these new results. And then today Eugenie Samuel Reich wrote a story about them for Nature News & Comment. I am sure at the upcoming APS March Meeting 2013 in Baltimore these materials will feature prominently, too. For sure we haven't heard the last of samarium hexaboride yet.

Source: http://allthatmatters.heber.org/2012/12/12/samarium-hexaboride/