PRESS RELEASE

Under cover of graphene

Berlin, Feb. 10, 2012

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Researchers at Helmholtz-Zentrum Berlin have developed a method to conserve electronic surface states using graphene.

Scientists at Helmholtz-Zentrum Berlin (HZB), together with colleagues from Dresden and Jülich, have succeeded in making the electronic surface-state of a metal extra-durable. To this end, they seal the surface of the metal iridium with a layer of carbon that has the thickness of a single atom. This modification of carbon known as graphene proves to be an efficient shield against outside influences. This ability to preserve the electronic surface-state is of paramount interest for spintronics. The HZB scientists have published their findings today in the journal "Physical Review Letters" (DOI: 10.1103/PhysRevLett.108.066804)**.**

Spintronics employs the magnetic moment - the spin - of electrons in order to process information. Surfaces are particularly well suited for distinguishing electrons with different spin, due to what physicists call a "broken symmetry". The electrons at the surface, on the other hand, are extremely active and easily form a chemical bond, with oxygen for example. Therefore, it has only been possible to preserve a particular spin state under extreme conditions, e.g. ultrahigh vacuum.
In their successful experiments to conserve the electronic surface structure, HZB researchers tested the metal iridium. "We treated the metal catalytically with propylene gas, a hydrocarbon" says project leader Dr. Andrei Varykhalov from the HZB department for magnetization dynamics. The surface allows for two competing reactions, explains Varykhalov, of which the graphenization wins out. "In this way, a single layer of carbon atoms forms on the iridium." HZB researchers studied this graphene layer as well as the spin states of the top layer of the metal with sophisticated analytical methods at the electron storage ring BESSY II. Their instrument contains an apparatus from particle physics, a so-called spin detector.
"At first, we were able to demonstrate that the spin states of the iridium do not change under the gaphene layer. This was in agreement with model calculations made by researchers in Jülich" Varykhalov explains. "In a second step we found that they also persist in the air". This is considered an important progress for spintronics. Varykhalov: "Our graphene-covered iridium is still a model system for research. If we succeed with graphene to also conserve the spin states of an insulator, we can bring realistic applications for spintronics within reach."

Homepage - Paper: http://prl.aps.org/abstract/PRL/v108/i6/e066804