Creating Denser Magnetic Memory

July 7 2009, by Miranda Marquit

(PhysOrg.com) -- One of the issues afflicting magnetic memory is the fact that it is difficult to store information for as long as 10 years. In order to overcome this problem, scientists and engineers have been looking for a way to increase the density of magnetic grains used for storage, as well as use a material with high magnetic anisotropy energy (MAE). Using cobalt (which has the highest MAE of ferromagnetic elements), a group at the Leibniz Institute for Solid State and Materials Research in Dresden, Germany, discovered a way to increase the density of magnetic grains in a data storage device.

In "Co dimers on hexagonal carbon rings proposed as subnanometer magnetic storage bits", Ruijuan Xiao and his colleagues describe a process in which it is possible to reduce the size of magnetic grains of cobalt from 50,000 atoms to 15,000 atoms. The trick, though, is to be able to guaranty that these grains can maintain their closely-packed hexagonal structure, which is key to maintaining cobalt's high MAE -- and its capability for long-term magnetic data storage. Technology Review describes how Xiao and his peers got around this issue:

"What Xiao and co have found is a way to trick cobalt dimers into thinking that they're in a hexagonal close packed structure. Their idea is to attach the dimers to a hexagonal carbon ring such as benzene or graphene. In this scenario, one of the pair of cobalt atoms bonds with the carbon ring, and the magnetic field between the cobalt atoms can be switched by applying a weak magnetic field and a strong electric field."

This way, spontaneous reversal of the magnetic field occurs more often than every 10 years, and magnetic data storage maintains its integrity longer. Additionally, this memory could be stored in magnetic grains held on Benzene rings only 0.5 nm across. Currently, magnetic storage with cobalt grains are 8 nm across. However, this work is so far theoretical. It has been modeled, but not tested in a real-world situation. If the idea holds up under experimental rigors, then it would mean a new age of long-term memory: More data, for longer periods of time, stored in smaller devices.