Magnetic atoms of gold, silver and copper have been obtained

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An international team led by Physics and Chemistry teams from the Faculty of Science and Technology at the University of the Basque Country (UPV/EHU) and directed by Professor Jose Javier Saiz Garitaonandia, has achieved, by means of a controlled chemical process, that atoms of gold, silver and copper - intrinsically non-magnetic (not attracted to a magnet) - become magnetic. The article has been published in the February issue of *Nanoletters* (Vol.8, No. 2, 661-667 (2008)).

According to the research, in which researchers from the UPV/EHU as well as teams from Australia and Japan have taken part, the magnetism appears reduce the dimensions of the material to nanometric dimensions and surround it with previously selected organic molecules.

The magnetism of these nanoparticles is a permanent one (like iron) which, even at ambient temperature, is quite significant. This amazing behaviour has been obtained not just with gold (a phenomenon which had already been put forward as experimentally possible) but, in this research, nanoparticles of silver and copper (the atoms of which are intrinsically non-magnetic) with a size of 2 nm have also been shown to be magnetic at ambient temperature.

The contribution of this work, part of the PhD of Ms Eider Goikolea Núñez and led by Professors Mr Jose Javier Saiz Garitaonandia and Ms Maite Insausti Peña, is not limited to obtaining these amazing magnetic nanoparticles.

In fact, by means of complex techniques, using experimental systems based on particle accelerators and nuclear techniques, both in Japan and in Australia, have clearly shown for the first time that magnetism exists in atoms of gold, silver and copper, metals which, in any other condition, are intrinsically non-magnetic (a magnet does not attract them).

This discovery goes beyond the mere fact of converting non-magnetic elements to magnetic ones. These properties appear in smaller-sized particles that have never been seen in classical magnetic elements. In fact, they can be considered as the smallest magnets ever obtained.

Moreover, such properties do not occur only at low temperatures but they are conserved, apparently without any degradation, at temperatures well above the ambient ones.

This work poses new questions as regards what have been the accepted up to now as the physical mechanisms associated with magnetism and opens the doors to interesting applications yet to be discovered, some of which are related to the use of magnetic nanoparticles for the diagnosis/treatment of illnesses. Likewise, this article is destined to be a point of no return for research into fundamental questions about magnetism.

Source: Elhuyar Fundazioa