

6 February 2007

By: Stefan Anitei, Science Editor



## **Volcanic Lava Could Boost the Production of Carbon Nanotubes and Nanofibers**

### *A research on Etna's magma*

The discovery in the early 1990s of the carbon nanotubes and carbon nanofibers, tiny structures constituted of pure carbon, meant a boom in the nanosciences and the birth of nanotechnology. Nanotechnology explores new properties of old materials at a microscopic scale, when their behavior is totally different. By now, their production on an industrial scale is still expensive, and their commercial employment in such domains as catalysis is not practical yet. But a recent research could change this state. A research team at the Fritz Haber Institute in Berlin has employed igneous rock from Mount Etna to make carbon nanotubes and fibers directly by deposition from the gas stage. The iron oxide molecules in the solidified lava turn it into an effective natural catalyst. This could be the way to an industrial scale production of nanotubes using a more efficient production method. Etna is Europe's most active volcano; it blasted last times in 2002 and 2003, when it expelled several million cubic meters of lava. Lava is rich in elements, and this trait may indeed help the synthesis of carbon nanotubes and nanofibers. Solidified lava is extremely porous and harbors large amounts of finely divided iron oxides, exactly like a mold needed for the fabrication of the tiny carbon nanostructures. The team ground the rocks and heated them to 700 °C in a hydrogen atmosphere, reducing the oxide to elementary iron. If a mix of hydrogen and ethylene is passed through the powder, the iron atoms will catalyze the decomposition of ethylene to elemental carbon and hydrogen. The carbon sediments on the lava in the form of nanotubes and nanofibers. As the new catalyst is found naturally in large amounts, the production will be much cheaper. The lava functions as both catalyst and substrate in one and the whole chemical reactions do not require watery stages. If a carbon source emerges, carbon nanotubes and fibers could appear in nature on minerals at relatively moderate temperatures. Volcano gases are rich in methane and hydrogen, so could have they formed carbon nanostructures in the early Earth? These forms could be also found in the space, as the interstellar space is rich in hydrogen, carbon oxides, and metallic iron.