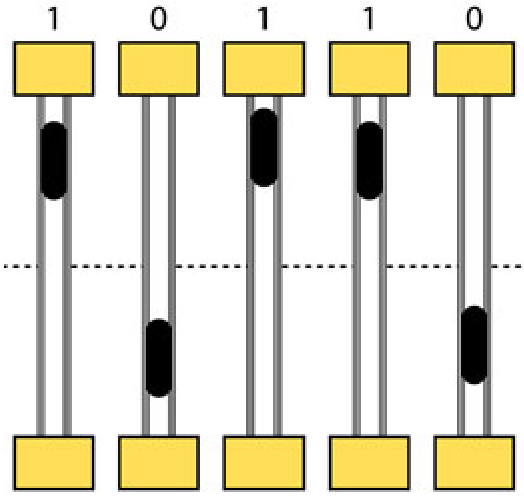
Not forgotten

How to store data for a billion years.



Zettl Research Group

Few human records survive long. One notable exception is the cave art in Lascaux, France. These Paleolithic paintings of wild horses have survived more than 16,000 years. Yet later artworks have been lost, and digital records are often the most vulnerable to decay. But in a recent issue of Nano Letters a team of researchers led by Alex Zettl of the University of California, Berkeley, describe a method that will, they reckon, let people store information electronically for a billion years.

Dr Zettl and his colleagues constructed their memory cell by taking a particle of iron just a few billionths of a metre (nanometres) across and placing it inside a hollow carbon nanotube. They attached electrodes to either end of the tube. By applying a current, they were able to shuttle the particle back and forth. This provides a mechanism to create the “1” and “0” required for digital representation: if the particle is at one end it counts as a “1”, and at the other end it is a “0”.

The next challenge was to read this electronic information. The researchers found that when electrons flowed through the tube, they scattered when they came close to the particle. The particle’s position thus altered the nanotube’s electrical resistance on a local scale. Although they were unable to discover exactly how this happens, they were able to use the effect to read the stored information.

What makes the technique so durable is that the particle’s repeated movement does not damage the walls of the tube. That is not only because the lining of the tube is so hard; it is also because friction is almost negligible when working at such small scales.

Theoretical studies suggest that the system should retain information for a long time. To switch spontaneously from a “1” to a “0” would entail the particle moving some 200 nanometres along the tube using thermal energy. At room temperature, the odds of that happening are once in a billion years. Yet the distance between the ends of the tube remains small enough to allow for speedy reading and writing of the memory cell when it is in use.

Dr Zettl says his team’s studies suggest that these cells could be used to make a memory with a storage density as high as 1 terabit (1 trillion bits of information) per square inch (6.45 square centimetres). In tests, the stored digital information was indeed found to be remarkably stable, in contrast to conventional memory cells in which information is sometimes lost because of randomly produced magnetic effects and the deterioration of the cell's material.

The next challenge will be to create an electronic memory that has millions of cells instead of just one. If Dr Zettl succeeds in commercialising this technology, digital decay itself may become a thing of the past.

NOT forgotten. **The Economist**, New York, June 16, 2009. Disponível em: <www.economist.com>. Acesso em: 18 jun. 2009.