The inside dope: new technique may speed the development of molecular electronics

Weizmann Institute scientists have developed a new technique that could lead to the development of inexpensive, biodegradable and versatile electronic components, which are made of single layers of organic (carbon-based) molecules.

Often, things can be improved by a little 'contamination.' Steel, for example is iron with a bit of carbon mixed in.

To produce materials for modern electronics, small amounts of impurities are introduced into silicon – a process called doping. It is these impurities that enable electricity to flow through the semiconductor and allow designers to control the electronic properties of the material.

Scientists at the Weizmann Institute of Science, together with colleagues from the US, recently succeeded in being the first to implement doping in the field of molecular electronics – the development of electronic components made of single layers of organic (carbon-based) molecules.

Such components might be inexpensive, biodegradable, versatile and easy to manipulate. The main problem with molecular electronics, however, is that the organic materials must first be made sufficiently pure and then, ways must be found to successfully dope these somewhat delicate systems.

This is what Prof. David Cahen and postdoctoral fellow Dr. Oliver Seitz of the Weizmann Institute's Material and Interfaces Department, together with Drs. Ayelet Vilan and Hagai Cohen from the Chemical Research Support Unit and Prof. Antoine Kahn from Princeton University did. They showed that such 'contamination' is indeed possible, after they succeeded in purifying the molecular layer to such an extent that the remaining impurities did not affect the system's electrical behavior.

The scientists doped the 'clean' monolayers by irradiating the surface with UV light or weak electron beams, changing chemical bonds between the carbon atoms that make up the molecular layer. These bonds ultimately influenced electronic transport through the molecules.

This achievement was recently described in the *Journal of the American Chemical Society* (JACS). The researchers foresee that this method may enable scientists and electronics engineers to substantially broaden the use of these organic monolayers in the field of nanoelectronics. Dr. Seitz: 'If I am permitted to dream a little, it could be that this method will allow us to create types of electronics that are different, and maybe even more environmentally friendly, than the standard ones that are available today.'

Source: Weizmann Institute of Science