Container transport on a nano scale

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Lock one or more molecules up within a cage of nanometer dimensions. Take this 'nanocontainer' to the desired spot and free the molecules. Or keep them locked up for a while and introduce other molecules into the container, for chemical reactions inside. By using polymers containing iron, it is possible to make intelligent containers of which the access of molecules can be regulated in a chemical way.

A research team led by prof Julius Vancso of the MESA+ Institute for Nanotechnology (The Netherlands) has succeeded in fabricating these nanocontainers. The scientists foresee exciting applications in e.g. medicine, in adding additives to food or in ultrafast reactions in nano chemistry. They present their results in the September issue of *Nature Materials*.

A true breakthrough in this research is the use of polymers having iron in their main chain. This is the material the containers are made of. By using iron, for the first time it is possible to adjust the permeability of the material via oxidation and reduction reactions. Scientist Mrs. Yujie Ma and Dr. Mark Hempenius, both of the group of Julius Vancso, succeeded in creating containers that can be opened and closed in this 'chemical' way. Oxidants or reductants take care of the access: een oxidant can be ironchloride, for example, a reductant could even be Vitamine C.

Chemical doormen

This selective access –one molecule gets in, the other won't- is the result

of the layered structure of the wall of the container. Polymer chains are layererd on top of each other and an electrostatic charge keeps them together. Influencing this charge with redox reactions, immediately influences the permeability of the wall. The container can contain a limited number of molecules, a soluble is already present inside.

As oxidation and reduction steps take part in numerous biochemical processes in water, the nanocontainers are useful for a variety of biological and biomedical applications. The scientists foresee applications in 'green' areas like food additives, medicine and cosmetics. In a more fundamental way, nanocontainers could be used in biochemistry to study large numbers of enzyme reactions at the same time and with high throughput.

The research, led by prof.dr. Julius Vancso of the MESA+ Institute for Nanotechnology of the University of Twente, has been done in close cooperation with the Group of prof. Helmuth Möhwald of the Max Planck Institut für Kolloid- und Grenzflachenforschung in Golm. The article 'Redox-controlled molecular permeability of composite-wall microcapsules' is published in the September issue of *Nature Materials*.

Source: University of Twente