NANO-STRUCTURES IN A **LIFE VEST**

A wearable "kidney" in the form of a comfortable vest, could improve quality of life for several million people suffering from kidney disease, and who currently need stationary dialysis. Blood purification requires an advanced chemical filter with a structure that must be precise right down to the atomic level. Experiments at the MAX IV Laboratory have provided important knowledge for a quality-assured production process.

Image Anna Stenstam at CR Competence needed proof that Triomeds dialysis filter had exactly the right structure.

CR Competence (CR) are experts in giving surfaces and interfaces special properties, by tailoring them at the nano level. Their clients are companies that need advanced knowledge of chemistry and qualified investigative methods for improved product development. One client is the medical technology company Triomed, which is developing a light, wearable dialysis vest, to provide kidney disease patients with increased freedom of movement. Dialysis takes place continuously, which means that the level of waste products in the blood is maintained at a constant low, enabling the wearer of the vest to feel better.

OPTIMIZING THE PRODUCTION PROCESS

Among other tasks, CR was commissioned to optimize the production process of one of the chemical filters that purify the dialysis liquid. The filter consists of a porous material with metal ions bound to a polymer matrix according to a very precise structure. Structure and function are closely linked – studying the effect of various process parameters on the structure provides a unique opportunity to follow the effect of the process on the crucial function.

"We needed proof that the production process was working as it should," says CR's CEO Anna Stenstam. "As we know exactly how the material needs to be in order to function optimally, we wanted to find a way to study it in the most minute detail – right down to the level at which we could see how the individual metal ions were bound to the polymer matrix."

A POWERFUL METHOD

In order to obtain a sufficiently detailed image of the filter material, there was only one viable method – EXAFS – available at the MAX IV Laboratory, in Lund. "We applied for experiment time at the MAX IV

Laboratory on behalf of Triomed via Science Link. The measurements with the EXAFS method gave us a very clear picture of the structure. The result is that we have been able to pinpoint exactly how we need to adjust the production process in order to obtain a perfectly functioning material. We have been able to provide both ourselves and our client with new knowledge and we have contributed to a better final product, all while saving time and money", says Anna Stenstam, who believes that Triomed may well conduct more experiments with EXAFS.

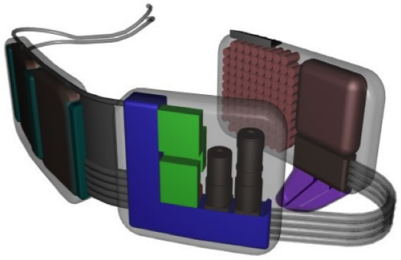

Image 2 - 3 Triomeds wearable "kidney" could improve quality of life for several million people suffering from kidney disease.

"The MAX IV Laboratory gives us access to powerful measurement methods that help us study and tailor materials right down to the nano level. It opens up completely new opportunities to create interfaces with specific functions, and the answers we get provide us with a fundamental understanding – which is crucial for sustainable and robust products and methods."

Image 3

Fact box:

Finding out how substances are structured at the nanometer level requires extremely sensitive methods. One such method is EXAFS, or extended X-ray absorption fine structure, which is used to investigate the structure of materials at the atomic level. The method relies on scanning the X-ray photon energy over a so-called absorption edge, i.e. the energy at which the inner electrons in a specific element start to absorb photons and are ejected from the atom. The appearance of the absorption spectrum provides information on what other kinds of atoms are present and the distance to them.

Science Link is a network between leading research facilities of photon and neutron sources and its users. The project aims to support and encourage innovation and entrepreneurship in the Baltic Sea Region. Apart from the research facilities, the network also includes scientific institutes, universities and regional organisations that serve as service and promoting units. Science Link is part-financed by the European Union (Baltic Sea Region Programme) and involves 17 partners from 8 countries during the project period 2012 to 2014.

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Baltic Sea Region Programme 2007-2013
Part-financed by the European Union (European Regional Development Fund)

Research facilities

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