Regulated drug release thanks to nano bubbles

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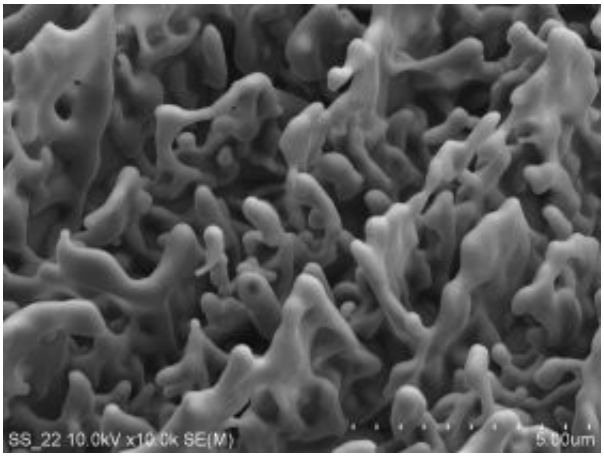

SEM image at a tilting angle of 45 degrees show the typical patterns of the nanostructures at the noble metal stent surface obtained with the new FZD technology.

Stents are medical implants that, for example, prevent the blocking of arteries after surgery. One of the problems using stents is the biocompatibility as the human body rejects and attacks foreign material. The Forschungszentrum Dresden-Rossendorf (FZD) developed a new method for making the surface of metal stents highly nano porous by producing millions of nano bubbles underneath.

This enlarged surface allows depositing and slowly releasing drugs over a longer period of time than with usual drug eluting stents. The market

leader for stents, the Boston Scientific Corporation in the US, focuses on this route to prevent the rejection of cardiovascular stents as this allows the targeted release of the drug right at the walls of the blood vessels.

Stents are implanted in certain organs as a supporting scaffold that reinforces the organ walls. Vascular stents act as small tubes made of metal or plastic mesh. The major problem in the application of stents is their compatibility with the human tissue: About 20 to 30 percent of the patients react with the rejection and the shut-down of the vessel. During the 1990's, vascular stents, which are coated with different substances, have been developed in order to solve this problem. This kind of drug eluting stent releases small amounts of a certain drug that constrains the regeneration of cells. In addition to the more conventional bare metal stent, more and more coated stents are used in Germany since 2002, especially for the treatment of coronary heart disease. Drug eluting stents are particularly effective in the treatment of diabetic patients, which make up 30% of the interventionally treated coronary patients and also carry the highest risk for renewed narrowing.

Physicists and chemists at the Forschungszentrum Dresden-Rossendorf developed an innovative method to create a large number of tiny pores with a diameter of a few ten to a few hundred nano meters (one nano meter being one millionth of a millimeter) on the surface of stainless steel. Dr. Natalia Shevchenko and Dr. Andreas Kolitsch from the FZD Ion-Beam Center bombard the surface of a stent from all sides with a high dose of noble gas ions. This generates a scaffold of nano pores in the material below the surface. Tuning the ion energy, the flux and the temperature during the process, the desired porosity can be precisely engineered. A larger amount of the highly effective drugs can be deposited on the enlarged noble metal surface, due to this nano porous structure, which enhances the biocompatibility of the implants in the human body. Thus, this treatment results in the release of drugs over a longer period of time. The method developed by the FZD is currently

assessed as a platform technology for the next generation of drug eluting stents by the Boston Scientific Corporation. The Forschungszentrum Dresden-Rossendorf and the Boston Scientific Corporation signed joint cooperation contracts with patent sharing. The objective of this research is to further develop this technique and to establish this method for surface modification in the private sector.

Source: Forschungszentrum Dresden Rossendorf