Applications of TiO_2 nanofibers produced by Nanospider™ technology

In addition to polymeric nanofibers, Nanospider™ technology allows to make ceramic electrospun nanofibers composed of a whole range of metal oxides. Compared to classical sol-gel approaches used to produce nanoparticles, electrospinning enables synthesis of nanofibers of the same materials with much more defined architecture and a narrow range of sizes. Combination of these features and specific material´s properties makes ceramic nanofibers very attractive for many application fields.

In particular, ttitanium dioxide - TiO_2 - nanofibers can be useful in the development and the realization of devices with advanced functionality for various markets. It is the unique combination of very high surface area (hundreds of square meters per gramm) and intrinsic semiconductive properties of TiO_2 that is responsible for an enormous potential of this novel material. TiO_2 nanofibers find their playground in photocatalysis, which is a very important cleaning process of our every day´s life. It is taking place on our household paintings, during disinfection of air in our air-conditioners up to large water cleaning stations used in industries of dyes and pigments.

Furthermore, TiO_2 nanofibers can be used in cosmetics. TiO_2 is one of the main components of sun lotions and is used there for its ability to absorb the UV light, thus protecting our skin from unwanted effects. Moreover, in contrast to nanoparticles, there is no risk of penetration through the skin due to its architecture and sizes that do not match with the skin pores.

Another possible application of TiO_2 nanofibes lies within photovoltaic technology. The so-called dye-sensitized solar cell is composed of a TiO_2 layer with a suitable dye (commonly a ruthenium dye) anchored on its surface. Since efficiency of such solar cells is also dependent on the amount of dye and the electron collection, it is very desired to have high surface area nanofibers that can be loaded with enough dye and help to transport electrons with less recombination.

Very important from the environmental point of view, TiO_2 and similar nanofibers could be used as catalytically active materials in the automotive industry. In particular, these low-cost and thermally stable materials can catalyse reactions leading to the reduction of the huge amount of greenhouse gases (CO_2, CO, NO_x etc.) produced by combustion of fuels in engines of vehicles. The improvement of the catalytic acivity over conventional layers of sintered nanoparticles lies in the availability of a large surface area and an easy transport of a reactant (gas) to the active sites on each nanofiber. Last, but not least, these materials provide clearly a much cheaper alternative to noble metals that are used currently in catalytic applications and are very expensive.

All in all, it is clear that these new materials with an unique nanofiber structure and guaranteed industrial productions rates will have great potential for manifold applications and will certainly contribute to ever increasing importance of nanotechnology.