

Nanotechnology: Benefits and Risks – A Challenge for Occupational Safety

(Thomas H. Brock)

Man had been exposed against chemical substances for all times. He was breathing the air earth provided, and this air contained gases, fumes and airborne solids—and it still does. Among these airborne solids always have been very small scale dusts well below the range of visibility. In nature these dusts are produced by volcanoes or all kinds of fires, e. g. Man has been producing this kind of materials too, most of the time being unaware of the formation. Baking bread means that huge amounts of particles are released from the oven, producing the beautiful dark-red coloured stained glasses in medieval times meant performing a reaction in the molten glass forming clusters Au_n ($n \sim 100$) of gold atoms, welding produces a broad range of particles, a lot of them in the nanometer scale. So the production of man-made nanoparticles is not exactly to be called new, also the application of nanotechnology—although unrealised—started at least hundreds of years ago.

These small scale solids are categorised using the dimensions. One category is dealing with particles, fibres and plates in the range of some nanometres. These *nanobjects* show at least one dimension on a scale of length between 1 nm and about 100 nm. Nanostructures can also be attached to surfaces or can be embedded in macroscopic structures, e. g. as pores in polymer foams.

A new dimension of problem awareness has come up during the last few years. With more and more designed nanoobjects, the number of new patents exploding and applications pushing on the markets, public awareness turned to the effects of nanotechnology on human health and the environment. At this point the dichotomy of nanotechnology becomes clearly visible: Nanotechnology is one of the —if not the—key technologies of the 21st century. The benefits are clearly visible, starting with simple amenities like shoe leather that does not get soaked with oily dirt and keeps clean for quite a long time, serving the environment with new systems for energy generation and storage or providing new means of cancer treatment with ferromagnetic nanoparticles that can heat tumours from inside the tumour tissue by coupling these nano-scaled antennae with an electromagnetic field. The label “Nanotechnology”—still—has a positive connotation for consumers. But there is the other side of the coin: we still do not know enough about the effects on the environment and on human health in particular. A lot of toxicological research has been done and is still going on, but the results are difficult to interpret, even sometimes inconclusive. So the call for a moratorium seems to be unreasonable, but occupational safety faces the challenge to take measures derived from incomplete knowledge. As far as we know our well established repertoire of measures is sufficient to cope with this challenge without risking workers health. But the need for more—even new—research is urgent.