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**Exposure of Engineered Nanoparticles to Human Lung Epithelial Cells: Influence of Chemical Composition and Catalytic Activity on Oxidative Stress**

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The astonishing physical and chemical properties of engineered nanomaterials have provoked an exponential growth of nano-products on the free market. Growing concerns over the impact of such materials on human health and the environment have initiated first in depth studies on the effect of nanomaterial exposure to biological systems and showed a high mobility of such materials in organisms or cells.

The present contribution investigates how chemical composition affects the generation of reactive oxygen species inside living cells. More specifically, twelve industrially important oxide nanoparticle samples containing Fe, Mn, Ti or Co and silica were exposed to lung epithelial cells (A 549). The intracellular generation of reactive oxygen species (ROS) was measured using an in vitro assay. In order to distinguish between effects arising from the presence of transition metals ions and nanoparticle-derived effects, the ROS formation was compared to the corresponding ion concentration (supplied as aqueous solutions) of these transition metals.

To avoid a potential interference of the biological assay with the nanomaterial three sets of control experiments elucidate the role of nanoparticles as carriers for heavy metal uptake. The present results indicate that the particles could efficiently enter the cells by a Trojan-horse type mechanism which provoked an up to eight times higher oxidative stress in the case of cobalt or manganese if compared to reference cultures exposed to aqueous solutions of the same metals. A systematic investigation on iron containing nanoparticles as used in industrial fine chemical synthesis demonstrated that the presence of catalytic activity could strongly alter the damaging action of a nanomaterial. This indicates that a proactive development of nanomaterials and their risk assessment should consider chemical and catalytic properties of nanomaterials beyond a mere focus on physical properties such as size, shape and degree of agglomeration.