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Substance-specific detection of palladium and nickel nanoparticles in the presence of a background aerosol

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Workers involved in the production or handling of engineered nanoparticles are likely to be at a high exposure risk. Different nanoparticle measurement devices are available, but they are not capable of distinguishing between the target particles and the background aerosol of the workplace (Kuhlbusch et al., 2011). In Neubauer et al. (2011) we introduced a new detection technique based on catalysis for the material-specific detection of nanoparticles with a high sensitivity. We now present further investigations concerning the suitability of this technique for the discrimination of catalytically active nanoparticles from a non-active background aerosol.

The catalytic behaviour of palladium and nickel nanoparticles was determined both directly after their production by spark discharge and after mixing them with background particles. They were sampled onto a filter for a fixed time interval and afterwards were exposed to reaction gases. As specific catalytic test reactions the hydrogenation of ethene and the oxidation of CO were chosen. The reaction products and hereby the catalytic activity of the nanoparticles were detected by infrared spectroscopy. In addition, the nano-aerosols were characterized by an electrical mobility spectrometer, by nitrogen BET and electron microscopy.

The results of the catalytic investigations show a proportional dependence of the catalytic activity of both palladium and nickel nanoparticles on their surface. Detection limits in the range of a few µg of the particles can be measured based on their catalytic activity. Even if background particles are added, the catalytic activity of palladium and nickel can be detected. Thus, our detection technique is indeed suitable for a discrimination of catalytically active particles from a non-active background aerosol.

Kuhlbusch TAJ, Asbach C, Fissan H, Gohler D and Stintz M. (2011) Nanoparticle exposure at nanotechnology workplaces: A review. Particle an Fibre Toxicology 8:22. doi:10.1186/1743-8977-8-22

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