



Nano-size Heavy Metal Particles in Authentic Air and Diesel Emission Particles

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Exposure to air-pollution with transition and heavy metals (e.g., Ni, Fe, V, Cr, Zn, Cd, As, Hg and Pb) may lead to human health effects. These elements are emitted from industry and combustion of fossil fuels (e.g., coal, oil and diesel). Focus has been set on the ultrafine nano-size particles that appear to be more toxic than larger-size particles. Knowing the speciation air-borne heavy-metal particles may facilitate a better understanding of the pathogenic mechanisms of particulate air-pollution. HAADF STEM is a strong tool for characterization of ultrafine particles (Utsunomiya et al., 2002; 2004). In this paper, an analysis of metal-bearing particles collected using a ten-stage MOUDI indoors and outdoors at a high-traffic Copenhagen street (Denmark), as well as a NIST SRM 2975 diesel emission particle standard and a 1985 VW 1600TD exhaust pipe particle sample for comparison. carbonaceous soot, sulphates, and nano-scale metal-compounds, dominate the ultrafines in both indoor and outdoor air. Ni-oxide with various concentrations of V, Fe, Co, Zn > Zn-oxide/Fe-oxide > Pb-oxide > (Fe,Ni)-oxide/(Zn,Ni)-oxide were the most abundant heavy metal particle types observed among the authentic ultrafine particles. ICP-MS analysis showed that the VW-1600TD sample was more abundant in metals (13.78 wt.%) than SRM2975 (0.22 wt.%). Notable chemical differences were observed between both of the diesel emission particle samples and the authentic samples. Hence, large variations in the ultrafine particle composition may occur depending on local sources. However, Fe- and Zn-oxides were among the most abundant phases in all samples. In vitro studies showed that these oxides play an important role in increasing the toxicity of diesel soot.

References: Utsunomiya, S., Jensen, K.A., Keeler, G.J., and Ewing, R.C.(2002) *Env. Sci. & Techn.*, 36/23, 4943-4947; Utsunomiya, S., Jensen, K.A., Keeler, G.J., and Ewing, R.C. (2004) *Env. Sci. & Techn.*, 38/8, 2289-2297.