

Assessment of airborne nanoparticles release during subtractive manufacturing

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The potential toxic of engineered nanomaterials is already well discussed among scientific community. However the possible harmful effects of unintended nanomaterials are not taking seriously enough. Conventional industrial processes are emission sources of unintended nanoparticles (NPs), whose toxic effects, for environment and human health, are not well known. The metalworking industry is an important sector, since its products are used by several industrial sectors, and therefore involves a significant number of workers. Subtractive manufacturing is a metalworking process, which includes techniques such as Electrical Discharge Machining (EDM) by means of graphite electrodes or cooper wire and also 3D laser machining. This work proposes to study occupational air environments, in terms of concentration of NPs and their respective size (TSI model 3034), in order to understand what workers are exposed to.

It was found that EDM brass wire technique (Fig. 1) presents the highest number of airborne particles, as well as the biggest percentage of NPs, which means the smallest average particle size. In contrast, the 3D laser machining proved to be the “cleanest” EDM technique.

The Precaution Characterization Ratios were determined using the results of this study, and in all the cases the recommended value [1] was exceed. This may means that further investigation is required to establish realistic Occupational Exposure Limits and/or that workers are exposed to high concentrations of NPs, so there is a need to take preventive measures.

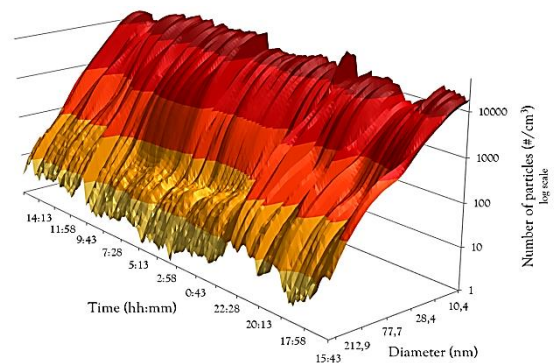


Fig. 1 - Size distribution of particles released from EDM using brass wire technique.

References

1. Sociaal Economische Raad, Provisional nano reference values for engineered nanomaterials, (2012).