Safe manufacturing and occupational exposure to nano-TiO_2. First experiences in foundry and steel metal sector.

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Abstract

The growth of new products and industrial processes based on nanotechnology has raised issues about occupational exposure. This work presents the measurements of occupational exposure (inhalation and dermal) to nano-TiO_2 that have been done in three case studies covering the life cycle of nano-enable products for the foundry and steel sector. It has been done inside the EHS-Advance project funded by the Basque Government (http://www.ehsadvance.com/).
The measurements have been done in industrial work environments and include processes of nano-powder manipulation, cold compressing, development of tablets of nano-TiO_2 and their final incorporation in a steel ingot in a steel making factory.

The exposure assessment strategy (inhalation) followed NIOSH (Bulletin 63) (NIOSH, 2011). Samples at the personal breathing zone have been collected for off-line ICP-MS and SEM/EDX analysis. Simultaneously, the aerosols released in the activities have been characterized using on-line devices following the tiered approach established by Asbach et al. (2012).Occupational exposure limit used for nano-TiO_2 are 0.3 mg/cm3 (NIOSH, 2011). The method to measure dermal exposure is inspired on ISO/TR 14294, specifically we have used a removal technique (wipe sampling); currently there is no limit value available for dermal exposure to nano-objects.

The results showed that the occupational exposure to nano-TiO_2 was below the selected OEL for all scenarios measured. On the other side, the characterization of the aerosol released during the different processes presented difficulties in some scenarios due to the strong influence of background in industrial environments (advanced statistical analysis is currently being performed). Finally the data on dermal exposure showed very low concentration on the hands of the operators, which may be due to residual contamination during sampling.

These results contribute to the design and adaptation of safe industrial processes developing nano-enable products for this sector. This study also has allowed the development of resources for the EHS-Advance initiative.

References

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