

Focus on IFA's work

Issue 5/2018

617.0-IFA:638.1

Exposure associated with additive manufacturing methods (3D printers)

Problem

The term "3D printing" is frequently used in lay parlance as a catch-all term for the various additive manufacturing methods. 3D printers encompass large-scale installations as well as the small desktop units. 3D printing methods are being used increasingly widely, leading both to fundamental changes in production and logistics. To date however, no adequate studies have been performed of the possible resulting health hazards. To close this gap, the DGUV Sub-committee Hazardous Substances and the Institute for Occupational Safety and Health (IFA) launched the "Emissions from 3D printers" research project in 2015.

Activities

In the MGU Measurement system for exposure assessment of the German Social Accident Insurance Institutions, the measurement programme entitled "Exposure associated with additive production methods (3D printers)" has been launched. The measurement programme is expected to run until the end of 2018.

The primary objective of the measurement programme as a whole is to obtain valid and exploitable measurement data on the workers' inhalative exposure during the use of additive manufacturing methods.

The measurements in the programme are performed by the metrological services of the



The term 3D printers covers substantially larger installations (right) as well as the relatively small desktop units (left).

German Social Accident Insurance Institutions and by the IFA. Altogether, discrete measurements have been performed to date in around 20 companies in additive manufacturing processes for the production of workpieces from metals and a range of plastics. The methods studied are laser-beam fusion, laser sintering, fused deposition melting, stereolithography, polyjet technology and electron-beam fusion. The exposure data are documented in the IFA's MEGA exposure database.

Depending upon the raw material used and the processing process, a number of hazardous substances may be released. In order for the substances to be identified consistently, a substance list was therefore drawn up based upon material safety data sheets and listing the most common materials, their relevant constituents, and possible reaction products.

Standard MGU procedures were used for sampling at the production sites. Subsequent analysis of the sampling media was performed in the IFA's laboratory.

Besides these obligatory measurements, the number density of ultrafine particles was determined at certain additive manufacturing installations by direct-reading instruments. These measurements were supplemented by reference measurements in the ambient air.

Results and use

Once the measurement programme has been completed, Recommendations for Hazard Identification of the Accident Insurers (EGUs) are to be produced. These recommendations are generally descriptions of exposure associated with methods and tasks involving hazardous substances, and are based upon the state of the art. In particular, they are intended to provide employers with practical guidance on the performance of risk assessments. The results are to be interpreted separately for installations processing metals, plastics or ceramics, and for desktop equipment.

The initial results indicate that the existing rules for low-dust working should be applied for the powder-based methods. Where metal powders are processed, the observance of fire and explosion safety principles is essential. In principle, the recommendations made for conventional printers, such as operation in a separate room with adequate ventilation, can also be applied to the smaller desktop 3D printers.

User group

OSH professionals at universities and other training establishments, users, accident insurance institutions.

Further information

- *Gib dem Staub keine Chance! – Zehn goldene Regeln zur Staubbekämpfung – VBG-Fachwissen*, 2016 (in German)
- *Additive Fertigungsverfahren werden die gesamte Produktion auf den Kopf stellen – Interview zu möglichen gesundheitlichen Gefährdungen durch 3D-Drucker*, IPA Journal (2016) No. 3, pp. 18-20 (in German)
- *VDI Statusreport – Additive Fertigung*, September 2014 (in German)
- *Characterization of emissions from desktop 3D printer and indoor air measurements in office settings*, Steinle, P.: J Occup Environ Hyg. (2016) No. 2, pp. 121-32
- *Richtlinie VDI 3405, 6.1* (in German), expected. 2018

Technical enquiries

Division 3: Hazardous Substances: Handling – Protective measures

Literature enquiries

IFA, Central Division