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XRF-analysis of fine and ultrafine particles emitted from laser printing devices.

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Abstract

In this work, the elemental composition of fine and ultrafine particles emitted by ten different laser printing devices (LPD) is examined. The particle number concentration time series was measured as well as the particle size distributions. In parallel, emitted particles were size-selectively sampled with a cascade impactor and subsequently analyzed by the means of XRF. In order to identify potential sources for the aerosol's elemental composition, materials involved in the printing process such as toner, paper, and structural components of the printer were also analyzed. While the majority of particle emissions from laser printers are known to consist of recondensated semi volatile organic compounds, elemental analysis identifies Si, S, Cl, Ca, Ti, Cr, and Fe as well as traces of Ni and Zn in different size fractions of the aerosols. These elements can mainly be assigned to contributions from toner and paper. The detection of elements that are likely to be present in inorganic compounds is in good agreement with the measurement of nonvolatile particles. Quantitative measurements of solid particles at 400 °C resulted in residues of 1.6 × 10(9) and 1.5 × 10(10) particles per print job, representing fractions of 0.2% and 1.9% of the total number of emitted particles at room temperature. In combination with the XRF results it is concluded that solid inorganic particles contribute to LPD emissions in measurable quantities. Furthermore, for the first time Br was detected in significant concentrations in the aerosol emitted from two LPD. The analysis of several possible sources identified the plastic housings of the fuser units as main sources due to substantial Br concentrations related to brominated flame retardants.

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