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1978

Link to publication

Citation for published version (APA):
Malmqvist, K., Johansson, G., & Akselsson, R. (1978). *Proton Induced X-rays and Gamma Rays for the Analysis of Welding Fumes*. Abstract from The American Industrial Hygiene Conference, Los Angeles, United States.

Total number of authors:
3

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Proton Induced X-rays and Gamma Rays for the Analysis of Welding Fumes

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Due to current fast progress in material science and welding technology, new, often complex, types of welding aerosols are continually being introduced into work environments. Demands for characterizing welding aerosols from different welding operations and for monitoring welding environments have thus arisen. Proton Induced X-ray Emission analysis, PIXE, constitutes a suitable method for trace element analysis in this context since it provides fast, multielemental analyses at low cost. The mass detection limits are of the order of 0.1-10 ng with an analysing time of 2-5 minutes. Quantitative analysis is possible for elements heavier than phophorus, the precision and accuracy being about 10 per cent.

When welding with electrodes with low hydrogen coatings, fluorine is a major constituent of the welding aerosol. Detection of this element is important in health applications but it is too light to be analysed with PIXE. However, by including a suitable detection system, we are able to detect simultaneously gamma rays from nuclear reactions for analysing the fluorine content, giving a lower limit of detection of about 100 ng. The low detection limits of this combination of analytical methods permit the design of low-flow (1 l/min) aerosol samplers, suitable for obtaining good particle size- and time-resolution data.

Results from the characterization of welding aerosols will be presented as well as results from measurements at different places.