

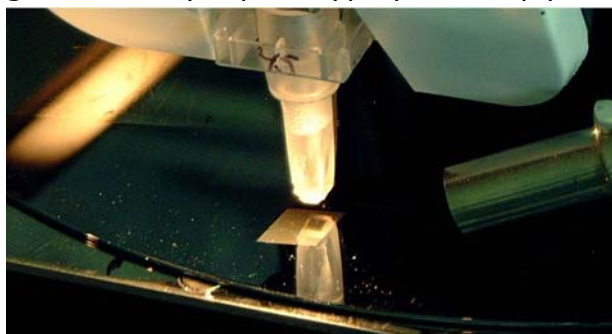
Potential for Prototype Picoliter Techniques for Calibration and Sample Preparation Techniques in X-Ray Fluorescence

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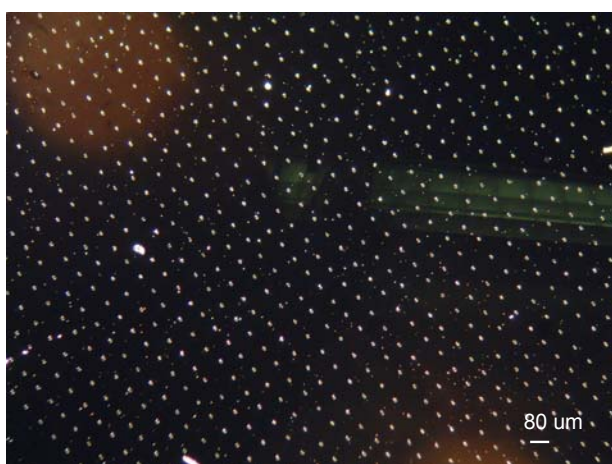
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Modified inkjet printers have been used for various purposes, where reliable jetting of small volumes is needed [1]. Just recently this technology has been adapted for analytical chemistry using a modified HP DeskJet printer [2]. In this study an HP picoliter pipette prototype was used called the Thermal Inkjet Pico-Fluidic System (TIPS).

Calibration In microscopic elemental analysis like MXRF, laser ablation (LA) related techniques or PIXE calibration of instrument response for a given amount of analyte is required. For many approaches the availability of an adequate reference material is lacking and therefore only semi quantitative results can be obtained. In this work we introduce a calibration strategy using dried residues from 1-200 pL aqueous droplets generated by a prototype picoliter pipette for MXRF analysis.



Sample Preparation The capability to analyze submicroliter amounts of samples easily achieved by total reflection X-ray fluorescence (TXRF) is a clear advantage compared to methods like ICP-MS or -OES; still high matrix concentrations can also hamper the TXRF analysis. Since the control of the drying process is limited, specimens may suffer from inhomogeneous distribution of standard and analyte and easily exceed the critical dimensions required for a precise analysis with GIMMXRF (ca. 4 μm). Smaller thickness and higher homogeneity of the specimens can be achieved by preparing the sample in arrays of very small droplets. Therefore in this study we compare the precision and sensitivity of analysis of aqueous samples prepared in arrays of nanoliter versus picoliter volumes.



Characterization of the picofluidic system We determined evaporation of solvent from the nozzle of the printer head to have a major influence on the deposited elemental amounts and showed how to overcome this problem.

Precision of dosing Custom calibration standards were created using the TIPS residues from single and multielemental standard solutions. **Accuracy** The accuracy of the dried spot approach was demonstrated by comparing multielemental deposits from the TIPS with the NIST 1833 and 1832 thin film standards

[1] De Gans, B.-J. et al. Adv. Mater. (2004), 16, 203-213.

[2] Fittschen, U. E. A. et al. Anal. Chem., 80, 2008; 1967-1977.