**Analysis of solid materials with resolution in the microscale – easy task or challenge?**

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During the last decade the demand for multidimensional investigation of samples and speciation in solid materials also pushed the developments in the field of X-ray spectroscopy and mass spectrometry. Although many of the promising developments in the field of X-ray techniques are connected with synchrotron facilities increasing efforts are directed to developments of tabletop instrumentations for everyday use in the laboratories. In mass spectrometry 2D- and 3D-imaging methods have been in the focus during the last decade.
In the field of 3D-investigations of elements or molecules in inhomogeneous or stratified samples several methods are available (e.g. SIMS, LA-ICP-MS, LIBS), but only few are capable of non-destructive analysis. Here, progress in the field of μXRF allows to measure the 3D distribution of elements in a sample and to quantify the analytes given certain conditions are met. Speciation in solid materials is no longer restricted to applications in the field of materials science or archaeometry, but gains importance in biology and medicine as well.

Of high interest for all techniques is also the development of suitable reference materials, e.g. stratified matrix matched materials (e.g. with a polymeric or silicon matrix), which could be used for the calibration of the different setups for 2D-imaging or depth-sensitive analysis and for quantification of real samples. Since all techniques mentioned aim for information at the micrometer scale, the reference materials have to be produced with sufficient homogeneity on the micro- or better nanometer scale.

The presentation will cover technical developments and reference materials development together with applications for 2D-imaging and 3D-analysis from the fields of geology, biology, organic chemistry and materials science.