# New insights in materials by coupling methods: Bringing µ-XRD$^2$, µ-RFA and µ-Raman together

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A lot of several types of µ-analysis tools exist meanwhile, especially for analysing different kinds of materials with spot sizes down to the µm-range and without time consuming preparation. In the last years, huge efforts were made especially in the field of X-ray analysis by using µ-focus X-ray tubes, focussing X-ray optics and modern 2-dimensional detector systems to dramatically decrease both, the spot size and the analysis time. Therefore, the next step will be mandatory, finally bringing all these µ-analysis tools together in one system.
A unique advantage of combining methods (for example µ-XRD$^2$ + µ-RFA or µ-RFA + µ-Raman) in one device is the possibility to obtain both, the chemical and the structural information at the same time and sample location without the necessity to move the sample between different devices.
Furthermore, coupling of µ-XRD$^2$ and µ-Raman-spectroscopy gives a much more detailed and complementary structural information of a material. For example, using vibrational spectroscopy in addition to X-ray-diffraction allows to characterize organic structures and detect even the presence of water. XRD on its behalf is an excellent tool for qualitative and quantitative phase determination of unknown crystalline compounds due to the availability of large reference databases.
Because of the complementary structural information of these methods at the end a coupling of µ-XRD$^2$, µ-Raman and µ-RFA would be essential to get all: detailed structural and chemical information together with only one device.
We will show different application examples from the fields of materials science and geoscience to demonstrate the possibilities and advantages of such an approach and will provide insights in first setups of coupling these three methods.