See the world with new eyes - Micro X-ray Fluorescence

Scheller, S.[1], Gloy, G.[2] and Tagle, R.[1]

[1] Bruker Nano GmbH, Germany, [2] Bruker Pty Ltd., Australia

Time decision making pressure is as present as ever in industry, as well as research and academia. Specimens come into the lab with a list of questions that must be answered, but which method is the most cost effective, or enables the result to be obtained? What if the specimen is prepared for light microscopy or scanning electron microscopy (SEM), which is time consuming and even costly, only to find out that the prepared specimens is not interesting, or does not provide sufficient insights into the problem? Or what if an invasive or destructive technique was used and now the specimen is destroyed, but the question was not answered? Or what if the specimen cannot be prepared, such as in forensics or paleontology?

To help solve these issues or dilemmas are the reason why the authors of this paper want to present a relatively new micro-analytical technique that is a complimentary tool to traditional microscopy and SEM, enabling screening and aiding decision making in the specimen analysis process. This tool can be used as the first instrument to perform non-invasive, spatially resolved chemical analysis in the micrometer range that assist in making decisions if and where further analysis should be performed and possibly also by which technique. The technique the authors want to present is the micro X-ray fluorescence (micro XRF) analysis, based on excitation by polycapillary focussed X-rays, and detection by energy dispersive X-ray spectroscopy (EDS). This technique allows automated optical image acquisition of the sample stage and x-ray analysis, similar to that with SEM and EDS, including point, line and mapping analysis. However, this technique is not that well known amongst electron microscopist or material scientists, but can provide invaluable insights, enable discoveries in extremely short timeframes and do this with lower owning and running costs. There are three strong analytical arguments why this techniques is better for screening and decision making than other methods. The first is that the specimen can be very large and requires little or no sample preparation, so not polishing or carbon coating. With the table top instrument 20 x 16 cm sized specimens can be analysed, while with the open system, up to 80 x 60 cm, with spot sizes down to below 15 um (for Mo Ka). The second strength is that the technique has excellent sensitivity for trace elements down to tens of parts per million (ppm) concentration, particularly for heavier elements and metals. The third argument is that this technique operates perfectly well in air, albeit with reduced sensitivity of light element below calcium, but can be negated through helium purging or evacuating the specimen chamber with the table top instruments (offering variable pressure/vacuum from 2 mbar to 800 mbar).

In the presentation the authors want to provide a brief introduction to the technique compared to SEM-EDS and numerous application examples from material science, including semi conductors and electronics, geology and mining, art and conservation, life sciences and coating thickness analysis.

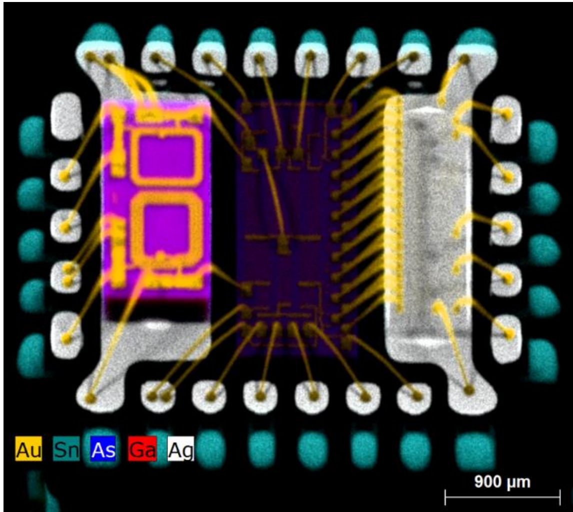

Figure 1 -XRF Map through package of a microchip

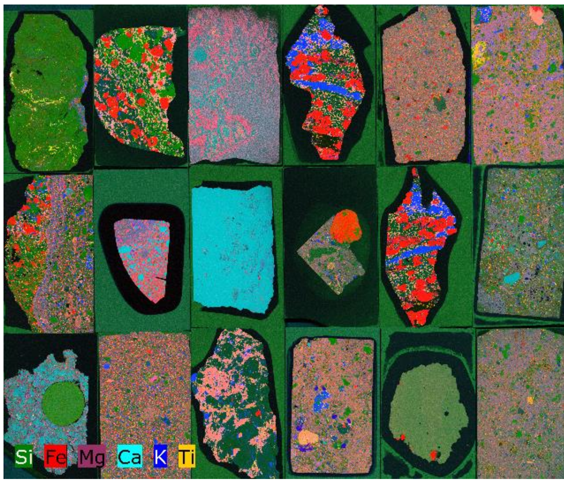

Figure 2 - XRF map of 18 geological thin sections