Crystal Analyser Laboratory at the ESRF

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The ESRF Crystal Analyser Laboratory (CAL), a laboratory completely dedicated to the development of spherically (cylindrically) bent analyser crystals for spectroscopic studies, has been operational since 2015. The CAL covers an area of roughly 120 m^2 including a "clean room" of 60 m^2 where the main processing tools are installed. At the moment the CAL is developing analyser crystals for 9 multi-analyser spectrometers at the ESRF but also provides optics to other X-ray light sources around the world. The domain of applications for such analyser crystals is quite wide including chemistry (energy storage materials, batteries), physics (correlated electron systems, liquid and glass dynamics), earth science, environmental science, catalysis, materials science and biology.

The laboratory is equipped with a combination of commercial instruments (wafer grinder, wafer dicing saw) as well as in-house designed fabrication and characterisation systems (for anodic bonding, cylindrical surface polishing, glue dispersion and inspection). The CAL manufactures essentially 3 types of analyser crystals (bent, bent-striped [1] and diced) mainly using Si, with the different types satisfying the various experimental conditions required by our scientists in terms of energy resolution, intensity and collected solid angle.

This poste will give an overview of the different technologies used for crystal analyser manufacture, describe the different processing capabilities of the CAL and describe the main development activities which are currently in progress. In particular, the latest improvements for the production of Von Hamos cylindrical analysers with radius R = 0.5 and 0.25 m will be shown and for the fabrication of both "single side" and "double side" machining of Johansson cylindrical analysers with radius R = 1 m.

A new system of vacuum-clamped analyser devices developed at the ESRF will also be presented. The system is intended primarily to host Ge bent and bent striped analysers and is similar to that presented by Jahrman [2] but much more compact in order to install many chambers in one line or in array. The preliminary results on Ge bent analysers indicate good performance and we intend to install this system in many ESRF multi-analyser spectrometers.

References

[1] - M. Rovezzi et al., Rev. Sci. Instrum. **88**, 013108 (2017).
[2] - E.P. Jahrman et al. , Rev. Sci. Instrum. **90**, 013106 (2019).