APPLICATION NOTE

Analysis of geological minerals using the ARL EQUINOX series X-ray diffractometer

Introduction

X-ray diffraction is commonly used in geology and mining (earth science) laboratories to characterize the mineralogical composition while XRF is routinely used for the chemical composition. Elemental and phase/mineralogical characterization of geological materials is of primary importance both in terms of assessing their natural resources and in terms of their exploration, beneficiation and extraction processes for industrial needs.

A number of analytical techniques are used for characterizing the geological materials depending on the elements of interest, their concentration ranges and specific mineralogical phases. XRF, ICP-OES, ICP-MS and other elemental analysis techniques are necessary to provide as complete information as possible in terms of major, minor and trace elements.

XRD, IR, Raman and other structural analysis techniques are used to obtain mineralogical and phase composition depending the on the nature of the materials and the relative concentrations of minerals of interest.

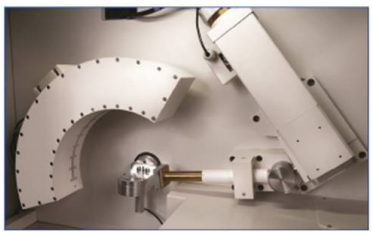
Among these techniques which provide complimentary information, X-ray diffraction and X-ray fluorescence (XRD/XRF) are most commonly used for both qualitative and quantitative analysis.

Instrument

Thermo Scientific™ ARL™ EQUINOX Series represent a portfolio of XRD instruments from simple, easy to use bench-top systems for routine analysis to more advanced floor-standing, high performance, research grade systems for investigative laboratories.

Thermo Scientific™ ARL™ EQUINOX 100 and Thermo Scientific™ ARL™ EQUINOX 1000 are bench-top XRD models utilizing different X-ray power sources, offering different levels of convenience and performance. The ARL EQUINOX 100 employs a custom-designed 50 W micro-focus tube (Cu or Co) which does not require an external water chiller. The same unit can be transported between laboratories or into the field and does not require any special infrastructure.

The ARL EQUINOX 1000 on the other hand uses a standard 2.2 kW source requiring chilled water cooling to the tube. The ARL EQUINOX 1000 is the only bench-top XRD with high power and standard XRD tubes ensuring optimum performance both in terms of resolution and sensitivity. Users can choose from either Ge monochromator (for high resolution) or HOPG monochromator (for high intensity) or both in a unique optional twin monochromator system (SIAM X), which allow the ARL EQUINOX 1000 to provide performance comparable to bigger and higher priced instruments.



The ARL EQUINOX 100 and ARL EQUINOX 1000 provide very fast data collection times compared to other diffractometers due to their unique curved position sensitive detector (CPS) that measures all diffraction peaks simultaneously and in real time. Geological or mining samples for XRD measurements are typically powders which are ground to suitable particle size.

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Figure 1: Geological sample recorded 10 minutes on ARL EQUINOX 1000 with Graphite monochromator

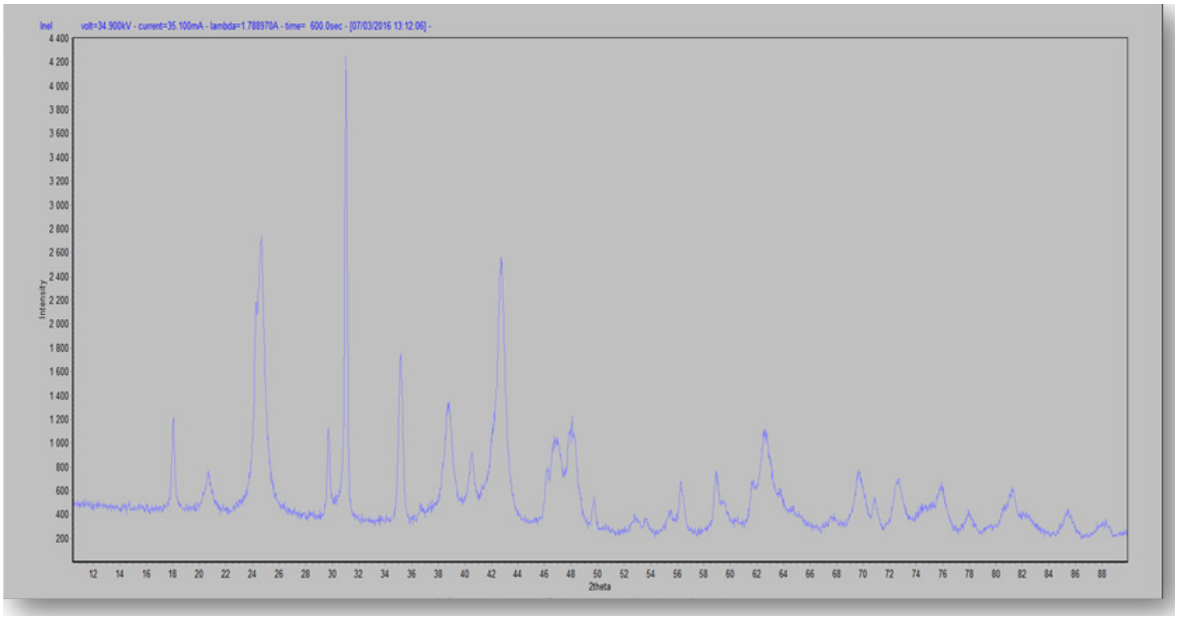
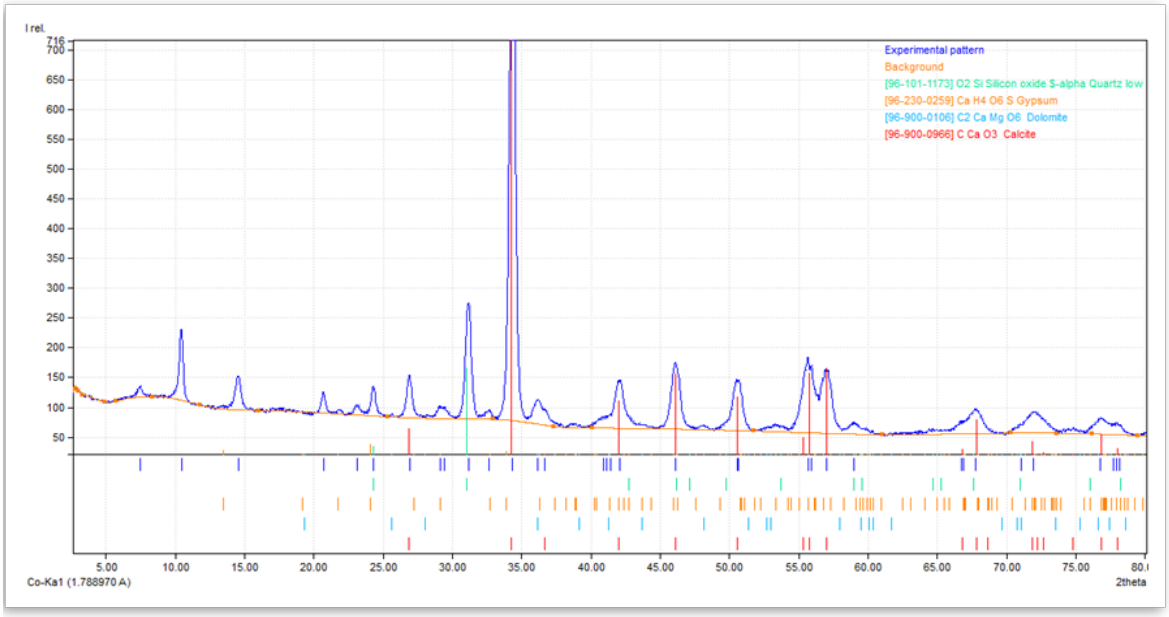


Figure 2: Overview on Limestone, Dolomite, Gypsum, and Quartz impurities



N.R.: The largest peaks with red vertical sticks are all Calcite = Limestone. Quartz peak is identified (blue vertical stick)

Software and Data Processing

The ARL EQUINOX XRD Series diffractometers come with a fully integrated data acquisition and processing software and can also interface with third party programs depending on the information to be obtained.

Conclusion

The ARL EQUINOX 100 and ARL EQUINOX 1000 models are fast, convenient and high performance X-ray diffraction instrument perfectly suited for geological and mineralogical studies both in terms of qualitative and quantitative data.

Thanks to the simultaneous acquisition of the full 2θ range, data can be generated and processed much faster than conventional XRD systems. This means, in routine analysis, a high throughput of samples can be processed and in an investigative laboratory (exploratory), more XRD measurements can be done on the same sample without compromising the analysis times.

Find out more at **www.thermofisher.com/xrd**

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