

Rigaku MSC



MiniFlex

Introduction:

The Rigaku Miniflex is a compact, portable X-ray diffraction system, which can be used in the laboratory and in the field at the sampling site. The Miniflex incorporates many sophisticated components, such as a vertical goniometer where one stepping motor scans both the θ and the 2θ axis. The automatic, variable divergence slit, a standard feature, keeps the area of irradiation constant on the sample regardless of the $\theta/2\theta$ angle. This allows better intensity at the higher 2θ range when compared to a fixed slit system. The newest, high-frequency X-ray generator and a smaller sized scintillation counter are also standard features on the Miniflex. These innovative technologies have resulted in a substantially more compact size (~22" w x 14" d x 23" h) and lower price than conventional powder diffractometers. This system offers an overall excellent cost/performance ratio.

Project:

Three typical drilling samples were collected, processed and analyzed by X-ray diffraction to show the capabilities of Miniflex diffractometer as a valuable tool in the drilling industry. The primary or predominate phase in the cutting sample was barite, a barium sulfate compound, with quartz as a secondary phase. This sample also contained trace phases of calcium carbonate and aluminum silicate. The calcite and dickite phases were good possibilities but a definite match was not found in the database.

The mud sample also contained barite, quartz and calcite, while the primary phase in the cement sample was calcium silicate with trace phases of calcite and gypsum. Grossular and anhydrite are also possible trace phases in the cement sample. The results of the analysis are shown in the table below.

Sample	High Confidence matches (high FOM)	ICDD#	Possible Phases ICDD#
Cuttings	Barite, syn #24-1035 Quartz, syn #46-1045	BaSO ₄ SiO ₂	Calcite, syn CaCO ₃ #05-0586 Dickite Al ₂ Si ₂ O ₅ (OH) ₄ #76-0632
Mud	Barite, syn #24-1035 Quartz, syn #46-1045 Calcite, syn #05-0586	BaSO ₄ SiO ₂ CaCO ₃	
Cement	Calcium Silicate Ca ₃ SiO ₅ (primary) Calcite, syn #05-0586 (trace) Gypsum (CaSO ₄)(H ₂ O) ₂ #70-0983 (trace)	#42-0551 CaCO ₃	Trace possible phases: Grossular (Ca _{2.9} Fe _{0.1})(Al _{1.9} Fe _{0.1}) (SiO ₄) ₃ #79-1267 Anhydrite Ca(SO ₄) #72-0503

Conclusion:

Samples were prepared, placed in the Miniflex diffractometer, and diffraction patterns were collected. Using the Search/Match feature of JADE, the phases were identified and the results are displayed in the above table. Phase identification is accomplished with the database of known materials published by the International Centre for Diffraction Data (ICDD).

The Rigaku Miniflex diffraction system is perfect for on-site analysis of materials related to oil drilling. With its small compact size and low power requirements (110VAC) it is capable of being placed in mobile labs or on offshore drilling sites. Users can easily transmit results to land based labs for interpretation by qualified lab personnel.