JK DROP WEIGHT TEST

MODEL-BASED GRINDING CIRCUIT TESTING, DESIGN AND OPTIMISATION

THE JK DROP WEIGHT TEST (DWT)

The JK Drop Weight Test [DWT] is a laboratory test to measure the breakage parameters of a rock sample. These parameters are required input for the JKSimMet autogenous mill modelling program.

The JKTech drop weight test provides ore-specific parameters which are used by the JKSimMet Mineral Processing Simulator software to analyse and/or predict AG/SAG mill performance. The same test procedure also provides ore-type characterisation for JKSimMet crusher modelling.

The drop weight tester breaks rocks in five size fractions (from 13.2 to 63 mm) at three energy levels. It simply involves dropping a weight from a predetermined height onto the rock so that it breaks.

The breakage products of all the rocks or particles for each size/energy combination are collected and sized. The size distribution produced is normalised with respect to original particle size. A single value, t_{10}, is used to characterise the size distribution. The t_{10} value is the percentage finer than 1/10th of the original particle size.

The ore is characterised for impact breakage by two parameters: A and b. The value of the multiplication of these parameters, the A*b value, has been found to have the best correlation with ore resistance to impact breakage. Lower values indicate harder ores. The table below shows typical ranges.

Low energy (abrasion) breakage is characterised using a tumbling test of selected single size fractions. The standard abrasion test tumbles 3 kg of -55 +38 mm particles for 10 minutes in a 305 mm by 305 mm laboratory mill fitted with 4 x 6 mm lifter bars. The t_a value describes the particle size distribution of the product. As with the A*b value, a lower value of t_a indicates a harder ore.

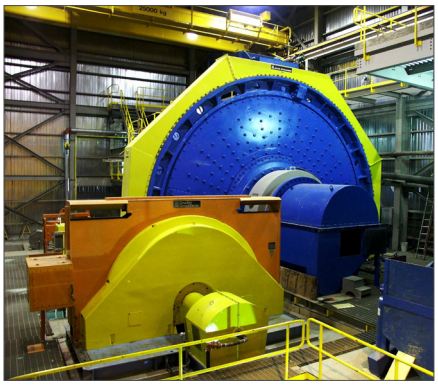
HOW ARE THE A, B AND TA VALUES USED?

The three values show a relative ore hardness by comparing them to other ore test data, compiled in a database by JKTech, as shown in the above data.

For autogenous mill or crusher design, the numbers are then used in the appropriate computer models, developed by JKTech, and part of the JKSimMet program.

WHEN SHOULD I DO A DROP WEIGHT TEST?

- For autogenous mill sizing. The DWT is used with JKTech autogenous mill modelling to size the autogenous mill(s) when designing a grinding circuit. ARMC generally recommends that, in these cases, the power-based design grindability tests (work index tests) are performed in conjunction with the DWT, to limit the risk in mill selection.
- When designing a grinding circuit that involves an autogenous mill. In addition to autogenous mill sizing, the JKSimMet program can be used to design the full grinding circuit and perform sensitivity analyses on various operating parameters.
- Grinding circuit optimisation. When the JKSimMet program is used to optimise a grinding circuit involving an autogenous mill, the DWT is used in conjunction with a circuit sampling survey to calibrate the models to the actual operation
- To calibrate the SAG Mill Comminution test



DWT Relative Values		Very Hard ←			Medium			→ Very Soft
A*b	Impact	< 30	30-38	38-43	43-56	56-67	37-127	> 127
t_a	Abrasion	< 0.24	0.24-0.35	0.35-0.41	0.41-0.54	0.54-0.65	0.65-1.38	> 1.38

WHEN SHOULD I USE THE DROP WEIGHT TEST AND WHEN THE SAG MILL COMMINUTION (SMC) TEST?

In general, the DWT is used to characterise the major rock types, and the SMC to determine the variability within that rock type. Although the SMC test is performed using the same test equipment as the DWT and produces anA and b parameter value, it is intended as a low-cost impact hardness mapping testing. There is no abrasion test associated with the SMC test and it is performed on one size only. The DWT is a better test to determine how a rock type will perform in an autogenous grinding mill.

HOW MUCH SAMPLE IS REQUIRED ?

At least 60 kg of minus 100mm + 12mm material is needed; 100 kg is preferred. Preparation of the sample into the specified size ranges is done at the time of testing. If the samples are diamond drill core, the core must be unsplit and be of a diameter large enough to extract "particles" of the largest size of 63 mm.

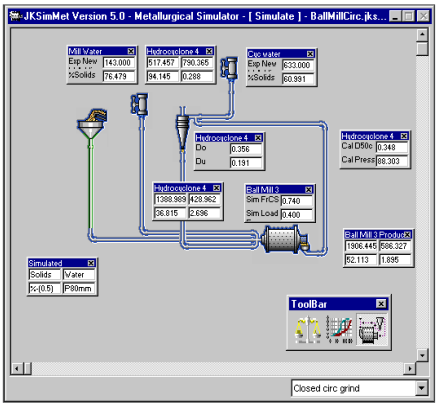
WHAT IS THE TURNAROUND TIME?

Turnaround for individual tests is two weeks. However, since samples are queded for testing in the sequence in which they are received, turnaround time can be longer.

HOW MANY TESTS ARE NEEDED?

The number of tests required depends on the objective of the test and the variability of the ore. For instance, in circuit optimisation, only one test per sample campaign is required, to calibrate the JK SimMet model. For grinding circuit design, the ore variability, sample availability, stage of design (pre-feasibility to final design), mine design, etc., all influence the answer.

These form part of the model-based approach to grinding circuit design and optimisation; in comparison to the power-based approach, based on the Bond and autogenous work index grindability tests. Both approaches are complementary and are offered.



CONTACT INFORMATION

Email us at minerals@sgs.com
www.sgs.com/mining