

COAL PHYSICAL TESTING

COAL ANALYSIS

SGS can provide the complete range of laboratory coal physical tests to meet all your requirements whether you are a producer, transporter or consumer of coal. All laboratory analysis is performed in accordance with recognized global standards. SGS lab capabilities include:

- Ash testing.
- Float- Sink testing.
- Washability testing.
- Hardgrove Grindability testing.
- Bulk density.
- Davis tube testing.
- Drop shatter and size analysis.

ASH TESTING

ASH FUSION

Understanding the behavior of coal ash at high temperature is critical in determining ideal coals for steam power generation. The ash fusion test gives an indication of the softening and melting behavior of coal ash at high temperatures within the boiler. Ash fusion temperatures are determined by heating a prepared sample of molded coal in a high-temperature furnace to temperatures exceeding 1,000 oC in both reducing and oxidizing conditions. The cone or pyramid of molded ash is monitored as the temperature increases. The four critical ash softening temperatures are determined by monitoring the increasing deformation of the sample as it is heated. Ash fusion testing by SGS will provide you with a valuable tool to estimate and control the slagging potential of your coal.

ASH VISCOSITY

Ash viscometer testing allows direct measurement of the temperature-viscosity relationship of your coal and coal blends. The high temperature ash viscometer generates a curve showing the temperature-viscosity relationship as seen in figure 1. The temperature at which the viscosity begins to increase rapidly is known as the temperature

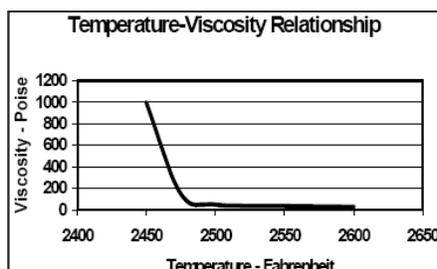
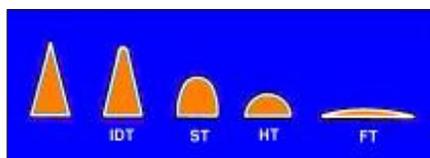
of critical viscosity (Tcv). Here slag crystallization is first likely to interfere with its flow properties. The upper limit for slag fluidity is approximately 250 poise. The temperature at which this occurs is known as the T250 temperature and it can be readily calculated from the graph in figure 1.

PHYSICAL ANALYSIS

FLOAT-SINK (WASHABILITY) TESTING

Washability characteristics of coal are generated from float/sink analysis of core samples, as mined samples, or from preparation plant feed samples. In addition to the float/sink analysis, SGS can perform froth recovery testing on the finer sizes. If a coal contains a high percentage of middlings material, SGS can perform the crushing studies required to determine if additional yield can be obtained by liberating coal from the middlings through crushing.

SGS coal float/sink analysis can be done on samples ranging in size from bulk washability samples (over 1 ton) to core samples (2-10kg). These analysis can be done over a range of densities (S.G.1.30 to 2.20) and on coarse to fine coal separation.



HARDGROVE GRINDABILITY TEST

The Hardgrove Grindability test is a measure of coal's resistance to crushing and attempts to reproduce the effects of continuous coal pulverization in a mill. A 50-gram sample of prepared coal of uniform size range is placed inside a grinding unit. The unit undergoes a standard number of revolutions under a specified pressure allowing steel balls within the unit to crush the coal sample. The coal fines are sorted and the quantity of coal less than a specified size is recorded and converted into a Hardgrove Grindability index (HGI) value. The HGI value is used by utilities to evaluate how coals will perform in their mills; this includes grinding power requirements and throughput capacities. Typical values lie between 30 (increased resistance to pulverization) and 100 (more easily pulverized). Experienced SGS technicians will ensure your HGI testing is completed promptly in accordance with global industry standards.

BULK DENSITY

The bulk density of coal particles in a sample is the mass of the coal divided by the volume that the coal particles occupy. Tests are done in either small or large container formats. Un-compacted bulk density is not an intrinsic property of a coal pile as it can change depending on how the coal is handled, how much moisture the coal contains at the time of testing, and the final geometric arrangement of the particles in question. SGS will perform your un-compacted bulk density testing in a manner consistent with ISO and ASTM standards.

FREE SWELLING INDEX

The free swelling index (FSI) is used to measure a coal's swelling properties when heated under prescribed conditions without physical restrictions. The FSI is obtained by heating prepared samples of coal over a burner and comparing the resultant coke button to a series of standard profiles. The FSI is useful in determining the plastic properties of coal, and as an indication of the coal's suitability for use as a coking coal. Industry standard FSI figures range from 0 (no increase in size) to 9 (greatest increase in size). FSI can be affected by moisture content, weathering, and the consistency of the pulverized sample. SGS ensures adherence to standard methodologies throughout the sample preparation and testing procedures to insure consistent results.

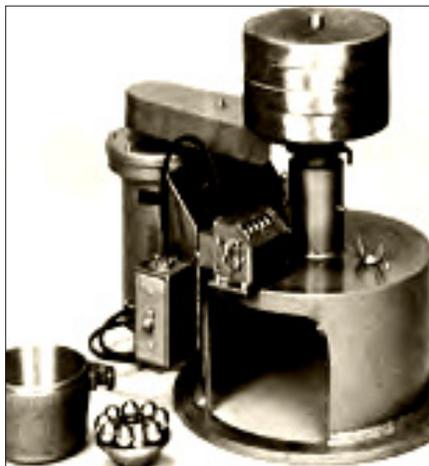
SIZE ANALYSIS

Size analysis testing determines the percentages of coal in each size fraction measured in a coal sample. The analysis involves measuring the weight of coal from a sample retained on screens with various size openings. The sieves are arranged in a column, with the largest holed sieves on top and progressively smaller ones below. Coal particles coarser than the sieve opening are retained on each screen as the apparatus is mechanically shaken for a specified amount of time. Each size fraction is weighed and reported as a percent of the total initial sample weight. For very fine coal wet screening is required to assist in the sizing operation.

Size analysis testing done by qualified SGS technicians can be used to characterize coal based on particle size for later processing or for commercial purposes. SGS will ensure that your size analysis tests are completed with the utmost attention to accuracy and integrity in accordance with industry standards.

DROP-SHATTER

SGS will perform drop-shatter tests to determine the ability of your coal to withstand breakage when subjected to handling and transport friability. This testing method involves dropping pre-



determined sized coal onto a steel plate from a specified height. The shattered pieces are screened and sorted and the mass of each size group is recorded. The percentage of the original sample that shattered into each size grouping is an indicator of the coals friability, and will allow you to estimate the capacity of your coal to resist breakage during handling and shipping at your facility.

FROTH FLOTATION

SGS can provide lab froth flotation testing to determine the flotation characteristics of your fine coal. SGS can provide froth cell testing that meets any standard or customer requirement.

OTHER TESTING RELATED TO THE PROCESSING OR UTILIZATION OF COAL

DAVIS TUBE TEST

SGS will determine the magnetic content of material from your heavy media processes through Davis tube testing. Sample material is placed in a glass tube at a 45° angle between 2 powerful electromagnets. A slurry sample is poured through the tube slowly and then the tube is rinsed with water so only a clean concentrate of magnetic material remains. Accurate Davis tube testing can facilitate improvements in your operational efficiencies by providing you with a reliable method of monitoring magnetite recovery and losses in your coal washing circuits.

FLY ASH RESISTIVITY

Resistivity is a measure of how easily the fly ash acquires an electric charge. Fly ash resistivity is the primary parameter that affects electrostatic precipitator performance; for example, high resistivity particulate is difficult for electrostatic precipitators to remove because it does not acquire a charge easily, whereas very low resistive particles can lose their charge too rapidly. SGS technical experts can provide you with complete fly ash resistivity testing in accordance with recognized industry standards.

ENVIRONMENTAL CONTROL MATERIALS

LIMESTONE, QUICKLIME AND HYDRATED LIME TESTING

SGS offers a full range of testing procedures for limestone, quicklime, and hydrated lime. Whether you are using limestone or limestone products for fuel gas desulphurization purposes, SGS can accommodate your testing requirements at one of our many state-of-the-art laboratories around the world. Our analysis on limestone, quicklime, and hydrated lime includes:

- Alkalinity
- Available lime index
- Combined oxides (aluminum and iron), silicon dioxide, strontium oxide, magnesium oxide
- Iron (ferrous total), manganese (bismuth method), sulfur trioxide, sulfur total.
- Elements determined by atomic absorption
- Free moisture and silica
- Insoluble matter including SiO₂
- Mineral analysis
- Phosphorous (titrimetric method)
- Loss on ignition (1000 °C)
- Reactivity
- Slaking rate
- Bond work index
- Carbon dioxide

The name SGS is recognized as the global benchmark for quality and integrity. Leverage our technical capabilities and allow us to minimize your risks associated with limestone and limestone product decisions. Enjoy the benefits of working with the world's leading inspection, verification, testing and certification company.

CONTACT INFORMATION

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