

CATALYST CRUSHING STRENGTH TESTERS ASTM D4179, ASTM D6175, ASTM D7084, SMS-1471

Importance of mechanical properties:

The mechanical strength of industrial catalysts and adsorbents is of outstanding importance for their manufacturing and packaging, as well as during loading and operation in the reactors. Two different mechanical characteristics are measured to determine this mechanical strength: the crush resistance and the attrition / abrasion resistance.

Vinci Technologies is pleased to introduce his new generation, **high versatility**, of catalyst crushing strength tester the **VCS (VERSATILE CATALYST CRUSHING)**:

- Single Catalyst Pellet Crushing Strength **ASTM method D4179 and D6175** (for spherical catalyst grains and for extrudates).
- Bulk Crushing Strength of catalysts **ASTM method D7084 and SMS-1471**.

Thanks to the Human Machine Interface, the VCS can be used for Single Crushing Strength or for Bulk Crushing Strength (the customer can order, the option, to use the same instrument as a Single Grain OR as a Bulk Crushing OR both).



ASTM D7084-4 & SMS-1471 BULK CRUSHING STRENGTH

Generally speaking, this piece of apparatus allows determination of the resistance to crushing of a bed of grains whose maximum dimensions is 6mm. The equipment consists of an automated press controlled.

The equipment complies with the **ASTM D7084-4** and the **SMS-1471** methods.

The test results and calculations are provided on a comprehensive analytical report.

After a representative catalyst sample has been dried in an oven at 300 °C during 1 hour then sieved with sieve opening 420 µm, 20 cm³ of the catalyst is taken and placed in the cell :

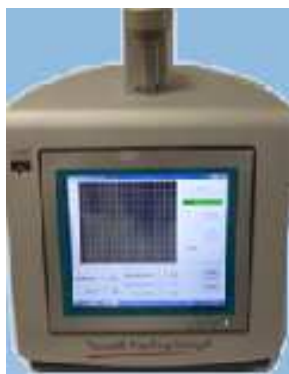
- The catalyst is covered with 5 cm³ of steel balls diameter 3 to 6 mm, according to the dimension of the grains, and then put on the anvil of the stress transducer.
- Increasing force is applied by the piston to the catalyst in stages of 3 minutes.
- The fines obtained at the different pressure stages are separated by sieving, and weighed: particles which pass through the mesh of a sieve of opening 420 µm (sieve ASTM n° 40) are considered as "*fines*".

The Bulk Crushing Strength is expressed in terms of the pressure necessary to obtain 0.5 % fines:

$$P(\text{MPa}) = \frac{F}{A}$$

F = Force to be applied on the catalyst in Newton to produce 0.5 % fines.

A = Cross-sectional area of the sample holder in mm².



ASTM D4179 & ASTM D6175 SINGLE GRAIN CRUSHING

The GCS works with single pellets as also with extrudates radial grains.

The grain is placed on the anvil of an appropriate transducer and a mobile piston, operated by a motor, crushes the grain. An electronic device, connected with the computer, measure the peak value when the grain breaks and keeps it displayed on the computer screen. The test results and calculations are provided on a comprehensive analytical report.

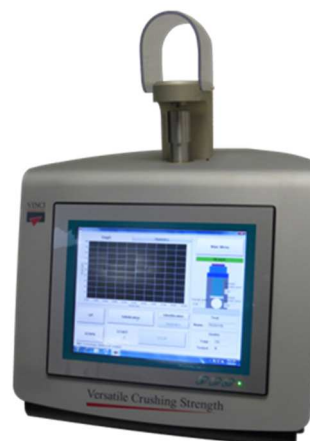
The tester is provided with several sets of Hammer-Anvil and Hammer-Holding showing standardized dimensions and made of stainless steel. The tester complies with the ASTM D4179 and 6175 methods.

Single pellet crushing strength ASTM D4179:

- A sample of 50 to 100 g of catalyst is dried for 3 hours in an oven at 400 °C. After cooling the catalyst in a dessicator, 20 to 50 grains are taken.
- Each grain is subjected to an increasing load up to breaking point (max load value 100daN): the force applied at the moment of break is determined in decanewton (daN).
- For spheroid catalysts, the results are expressed in decanewton (daN), i.e. in force.

Extrudates radial crushing strength ASTM 6175:

- A sample of 50 to 100 g of catalyst is dried for 2 hours in an oven at 300 °C. After cooling the catalyst in a dessicator, 20 to 50 samples are taken.
- Each extrudate is subjected to an increasing load up to breaking point (max load value 100daN): the force applied at the moment of break is determined in decanewton (daN).
- For extruded catalysts, the results are expressed in daN/mm if the load is applied along a generating line.



VERSATILE CATALYST CRUSHING STRENGTH TESTER

The mechanical strength of industrial catalysts and absorbents is of outstanding importance for their manufacturing and packaging, as well as during loading and operation in the reactors. Two different mechanical characteristics are measured to determine this mechanical strength: the crush resistance and the attrition/abrasion resistance.

The high versatility, new generation, catalyst crushing strength tester the **VCS (VERSATILE CATALYST CRUSHING STRENGTH)** is showing high versatility:

- Single Catalyst Pellet Crushing Strength and complies with the **ASTM method D4179 and D6175** (for spherical catalyst grains and for extrudates).
- Bulk Crushing Strength and complies with **ASTM method D7084 and SMS-1471**.

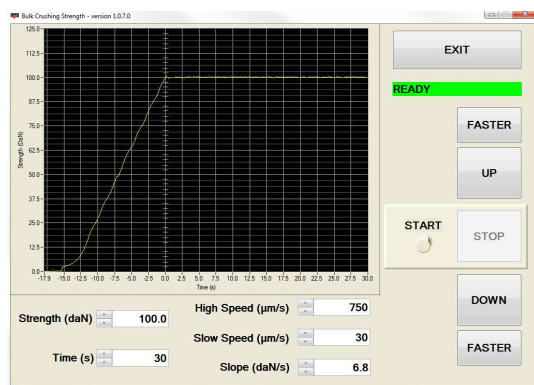
In compliance with the three ASTM methods the versatile catalyst crushing strength tester is provided with several sets of Hammer-Anvil and Hammer-Holding showing standardized dimensions and made of stainless steel. Generally speaking, this piece of apparatus allows

determination of the resistance to compressive force of catalyst or catalyst carrier sample whether in regular shape, irregular shape, spherical form, pellet form, tablets, extrudates, etc. The equipment consists of an accurate force sensor controlling an automated press controlled via a stepping motor: The tester is provided with several sets of Hammer-Anvil and Hammer-Holding showing standardized dimensions and made of stainless steel.

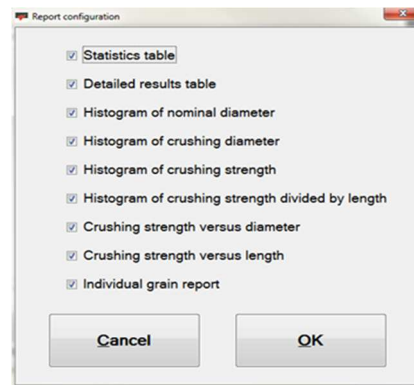


Thanks to his Human Machine Interface the tester is user-friendly and allows access to useful and pertinent data:

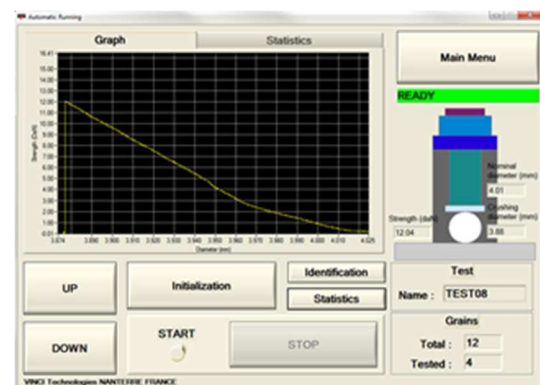
- *Catalyst sample diameter (nominal & crushing diameter)*
- *Crushing Strength (daN)*
- *Crushing Slope (daN/mm)*
- *Applying Force rate (daN/s)*
- *Minimum value, maximum value and standard deviation for those data (sample batch configuration).*
- *Results of tests and calculations are provided on a comprehensive analytical report.*



Bulk Crushing Strength



Report Screen



Grain crushing screen

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