ATTRITION IN FLUIDIZED BED

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.

ATTRITION IN FLUIDIZED BED
(ASTM D-5757-95)

VINCI Technologies offers a specific equipment to determine the attrition of powdered catalysts in fluidized bed, particularly suitable for FCC catalysts (fresh or steamed) and the like (size range 10 to 180 microns).

This attrition is measured by subjecting a sample to fluidization with humid air jets. The percentage of fines after a 5 hour test is the Air Jet Attrition (AJI).

For attrition and abrasion testing of granular catalysts, VINCI Technologies offers two testers: the rotating drum tester (ASTM D4058 96) and the rotating tube tester (SPENCE method).
DESCRIPTION

- Air supply source delivering a controlled air flow at 0.5 kg/cm² gage, 35% humidity content (obtained by bubbling in a 25 cm – high water column) and at room temperature.

- Attrition – disengagement section including an attrition tube fed at its bottom with an air flow through 3 holes and topped by a disengaging tube three times larger in view of separating the catalyst and the fines as produced, thus keeping the catalyst in the attrition tube and carrying over the fines only.

- Fines collection section including a specific filtering collector, followed by a wet gas-counter to determine the air flow.

Sizing of the here-before pieces of equipment complies with the requirements of the ASTM method.

SAMPLING THE POWDERED CATALYSTS

The procedure to get a 50g sample of humid catalyst is as follows:

- Obtain a representative sample of 65 g by usual riffling or splitting of the larger composite.

- Screen the sample through a N°80 (180µm) ASTM sieve to remove any particle larger than 180 µm.

- Humidify the powdered catalyst sample using different procedures for fresh or non-fresh FCC catalysts to get a sample at 30-40% humidity.

PREPARING THE APPARATUS

It is made clean and dust-free and the various sections are assembled except the fines collector. The air-flow is humidity-adjusted at 30-40%. The wet gas meter is connected with the top of the disengager and the air-flow is adjusted to 600l/h and a pressure of 0.5 kg/cm² gage.

Two fines collectors are prepared and the filters are conditioned by implementing them on the apparatus, in succession and submitting them to the humidified air-flow for half an hour. Then they are recovered, weighed and stored.

TEST PROCEDURE

Air flowing as required and fines collector off, charge 50 g of water-equilibrated sample through the top of the disengager, quickly secure one of the two fines collectors and start the time-keeping.

After one hour, replace the fines collector and continue the test for another four hours (total test duration is five hours). Each fines collector is weighed immediately after recovery.

Disassemble the attrition section, recover the sample from the attrition tube and the disengager, weigh it.

Clean the equipment.

CALCULATIONS AND REPORT

1. Calculate the wt.% of fines formed during the first hour:

   Fines (1) wt.% = \( \frac{m_1 - m_0}{m_s} \times 100 \)

   \( m_5 \): sample weight
   \( m_1 \): collector N°1 weight
   \( m_0 \): void collector N°1 weight

2. Calculate the AJI, total formation of fines, as follows:

   \( AJI = Fines (5) \) wt.% = \( \frac{m_5 + m_s - m_0 - m'_0}{m_s} \times 100 \)

   \( m_5 \): collector N°2 weight
   \( m_0 \): void collector N°2 weight

3. Sample recovery in view of losses appraisal:

   Recovery (wt.%) = \( \frac{m_1 + m_s + m_r - m_0 - m'_0}{m_s} \times 100 \)

   \( m_1 \): mass of sample recovered in attrition tube and disengager

Report: containing the following information:
AJI, 1st hour fines formation, recovery