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## Stone and rock crushing process

### Stone and rock crushing process

Crushing refers to the process of reducing rock into smaller chunks. Rock crushing is a very complex process, as in the process of crushing, a number of factors will influence the crushing ratio. The main factors are: material resistance strength, hardness, toughness, shape, size, humidity, density, homogeneity, and external conditions, such as the instantaneous interaction and distribution of materials at the moment of crushing. All these factors make the process of breaking complicated, and so far a unified and complete set of mathematical theory is not achieved to explain the crushing ratio.

Crushing process does not happen by itself and it is not reversible. The external force must overcome the internal cohesion between particles in the rock. The cohesion, even for the same rock, differentiates greatly. It depends not only on the nature and structure of crystals in the rock, but also on the deficiencies of the crystals. These deficiencies may be macro- or micro-cracks. Due to the presence of cracks in the crystal, the connection between crystals becomes weak.

We can see from the mechanics of materials, materials subject to external force, in the event of damage, first produce elastic deformation, when material was not damaged. When the deformation reaches a certain value, the material hardening, the stress increases, and thus deformation to continue. When the stress reached when the elastic limit, permanent deformation began to emerge, materials into the plastic deformation state. When the plastic deformation reached its limit, the material damage could arise. Of course, rock and mineral materials, the yield point is obvious.

It can be detected from observing cross-section that the rock is crushed by pressing fracture (or tension fracture) due vertical forces outside; or slip due to shear stress; or both. For example, exert pressure to brittle materials from above until it reaches the limits of the specimens' compression. The materials is only destroyed along the vertical at the moment; if you continue to exert pressure on the materials, the specimen will be fractured, that is, crushing. The rock crushing can be divided into three stages.

- (1) splintering stage, energy absorption and very few large pieces crushed.
- (2) crushing stage, large pieces crushed.
- (3) compaction stage, sheet pieces broken, producing small chunks.

In fact, because it is difficult to measure the compressive stress on different parts of the material, it is difficult to calculate the stress distribution. Clearly, in order to make material crushed and fractured, not only the compressive stress acting on the fracture surface must reach a specific value, but also the distance dragged on the fracture surface matters. Therefore, the crushing capacity depends on the crushing power (energy).

### Common fragmentation processes

In mining, there are two-phase and three-phase crushing processes. Two-phase crushing process can be open-circuit and closed-circuit. For the latter, the crusher and screen form the closed-circuit, which guarantees the product size can meet the requirements. It is only suitable for small mines, the total ratio is 15-25 or so and the capacity is often less than 1000 tons / day.

Take the material(<300mm) for example, after the first pre-screening (sieve hole 75 mm), the material of 0-75mm is sieved out while the material of 75-300 mm enter into the crusher. The crushed material combined with the sieved out material is screened again (sieve of 15 mm), material of 0-15mm is sieved out to become the product. Material of 75-15 mm will return to crushers for re-crushing. The process goes on and on until the material reaches the required size.

Open-circuit crushing process is rarely used, except certain re-election factories. They usually use rod mill to further process the products after open-circuit crushing.

Three-phase crushing process also can be open-circuit and closed-circuit. The pre-screening can either be adopted or not. The open-circuit is seldom used as it cannot guarantee the product size meets the requirements. The closed-circuit process is the most common process. It is applied in large, medium and small-scale concentrating mill. The crushing ratio is up to 25-200 or so, the maximum feed size is up to 1,000 mm and the final product size can reach 12mm or even finer.

In certain cases, some big concentrating mill adopts four-phase crushing process, which can achieve finer product size and increase the efficiency of each phase.

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