

المحاضرة الثانية (industrial rock and mineral)

Mineral Processing Technology (Treatment and Beneficiation):

The stages involved vary from one ore to another, different kinds and grades of ore need different treatments. Mineral processing is concerned mainly with the physical methods of separation:

1. -Optical and radioactive separation: Separation depends on optical and radioactive properties.
2. Crushing and grains (particles) size separation: Crushing is involving the mechanical breakdown of the large lumps of mined ore into small fragments. The main purpose of the processing is to liberate the valuable particles of ore from the barren rock. The primary crusher is to reduce the size from 50cm to 20 cm. The secondary crusher breaks down the particles to 2-0.5cm. These small fragments next was grinding by steel ball mill to take the ore between 300-100 μ m. The concentrating processes exploit differences in hardness between particles of minerals - soft minerals as small particles, hard minerals as larger. Grains separate about size by sieve analysis (handing or shaker) or sedimentation or by centrifuge instruments.
3. Specific gravity separation: Separation depends on specific gravity differences of minerals due to mass effects . Minerals are separated by heavy liquids like carbon tetrachloride (CCl₄) (sp. gr. 1.58 -) bromoform (sp. Gr. 2.89), methylene iodide (sp. Gr. 3.72).
4. Froth Flotation separation: Separation utilizing the different surface physiochemical properties of the minerals - froth flotation as air bubbles.
5. Electrical conductivity separation :Separation depends on electrical conductivity properties, it use to separate conducting (Au, Cu, & Ag) from non-conducting (S & C) or semi-conducting (Si & Ge).
6. -Thermal treatment separation: Like calcination of carbonate or sulphate to prepare lime or plaster & dehydration .
7. Magnetic separation: Separation depends on magnetic properties, ferromagnetic minerals like magnetite(Fe₃O₄), paramagnetic minerals like hematite (Fe₂O₃) and diamagnetic minerals like pyrite (FeS₂). Magnetic separation is an important process in the beneficiation of iron ores, bauxite ore, silica sand, kaolin clays

Characteristic properties of industrial minerals and rocks:

- 1- Chemical purity & mining properties such as salts, limestone, sulphur.
- 2- Physical or mechanical properties such as porosity, compressive strength, shape and grain size. Example: crushed stone or sand & gravel in concrete.
- 3- Very fine grained, high porosity, super ability for absorption such as Diatomite.

4- Silicates fibers are used for fire proofing at high temperature.

Economic aspects:

Most of industrial minerals and rocks are plentiful which they occur in bulk like clays, sands, gravels, limestone, and shale. The processing necessary to convert the raw materials into a usable product is simple, like sand & gravels are easy to excavate and require washing to remove clays and screening to get right proportion. The materials which are large in bulk are low unit value (intrinsic or low monetary value) and high place value. The unit value for which a unit weight or volume of the product can be sold.

They are rarely imported or exported and produced by common geological processes. They are affected by economic fluctuations, production of materials has increased in response to a rising demand. The materials which are limited occurrences (low place value) and special properties are high unit value. They are exportable and importable, example is china clay (kaolin), marble, mica, asbestos, magnesite, barite, sulphur, diamond.

Classification of industrial minerals & rocks:

Classifications of minerals and rocks is difficult because the diverse and changing industrial applications. Classification based on:

- 1- The nature of geological occurrences and origin.
- 2- The chemical properties.
- 3- The physical properties.
- 4- Economical properties.
- 5- Uses of materials.

☐ One of these classifications is classification of Bates, 1969, alphabetical listing of

industrial minerals and rocks: Asbestos, Barite, Cement, Clay Diamond, Gypsum, Lime, Magnesite Phosphate rocks Quartz Refractories Sand & Gravel Sulphur Talc Vermiculite