# SEPARATION PROCESS

# PARTICLE HANDLING & PROCESSING

# Part 1

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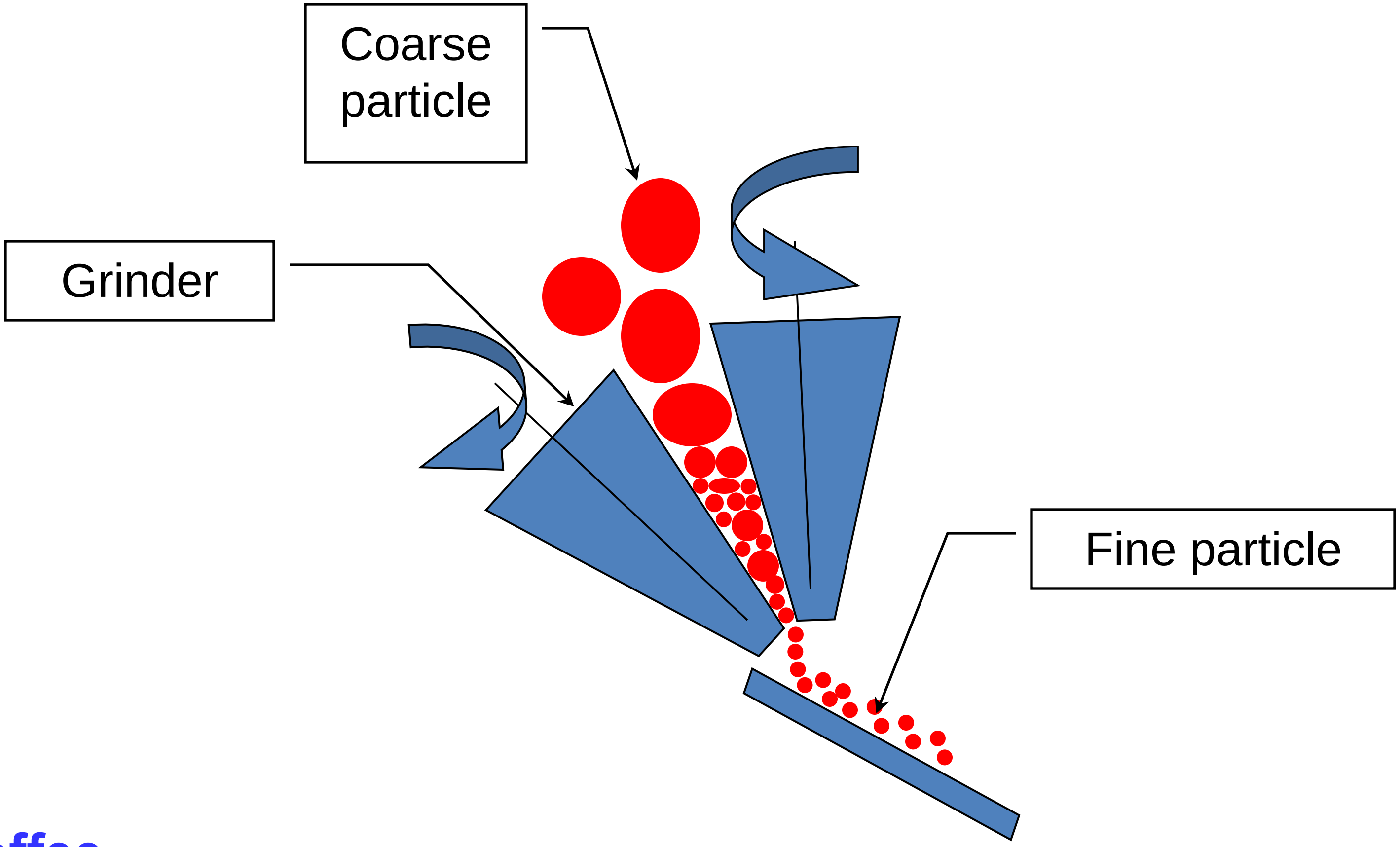
# Mechanical size reduction

## Why do we need a size reduction?

- easier handling – workable size
- increase reactivity – small size large surface area
- separation of unwanted material via mechanical method
- meet industry specification – small MSG and NaCl crystal

# Mechanical size reduction




**Coffee…..**

# Theory

Estimating the power required for crushing and grinding using Bond postulate

$$\frac{P}{\dot{m}} = \frac{K_b}{\sqrt{D_p}}$$

$K_b$ is a gross energy requirement in KWH per ton of feed needed to reduce a very large feed to such a size that 80% of the product passes a 100 µm screen. If $D_p$ in mm, P in KW

$$K_b = \sqrt{100 \times 10^{-3}} W_i$$

If 80% of the feed passes a mesh size of $D_{pa}$ mm and 80% of the product passes a mesh of $D_{pb}$ mm

$$\frac{P}{\dot{m}} = \frac{0.3162 W_i}{\sqrt{D_{pb}} - \sqrt{D_{pa}}}$$

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**TABLE 28.2**
## Work indices for dry crushingt† or wet grinding‡

| Material | Specific gravity | Work index $W_i$ |
|---|---|---|
| Bauxite | 2.20 | 8.78 |
| Cement clinker | 3.15 | 13.45 |
| Cement raw material | 2.67 | 10.51 |
| Clay | 2.51 | 6.30 |
| Coal | 1.4 | 13.00 |
| Coke | 1.31 | 15.13 |
| Granite | 2.66 | 15.13 |
| Gravel | 2.66 | 16.06 |
| Gypsum rock | 2.69 | 6.73 |
| Iron ore (hematite) | 3.53 | 12.84 |
| Limestone | 2.66 | 12.74 |
| Phosphate rock | 2.74 | 9.92 |
| Quartz | 2.65 | 13.57 |
| Shale | 2.63 | 15.87 |
| Slate | 2.57 | 14.30 |
| Trap rock | 2.87 | 19.32 |

†For dry grinding, multiply by $\frac{4}{3}$.

‡From Allis-Chalmers. Solids Processing Equipment Div., Appleton, Wisconsin, by permission.

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# Credit to the authors:

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Ahmad Ziad Sulaiman, Prof
Azilah Ajit
Hayder Bari, Prof
Rosli Mohd Yunus, Prof