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# *Fluidization: Mechanisms of fluidization* characteristics of gas-fluidization systems

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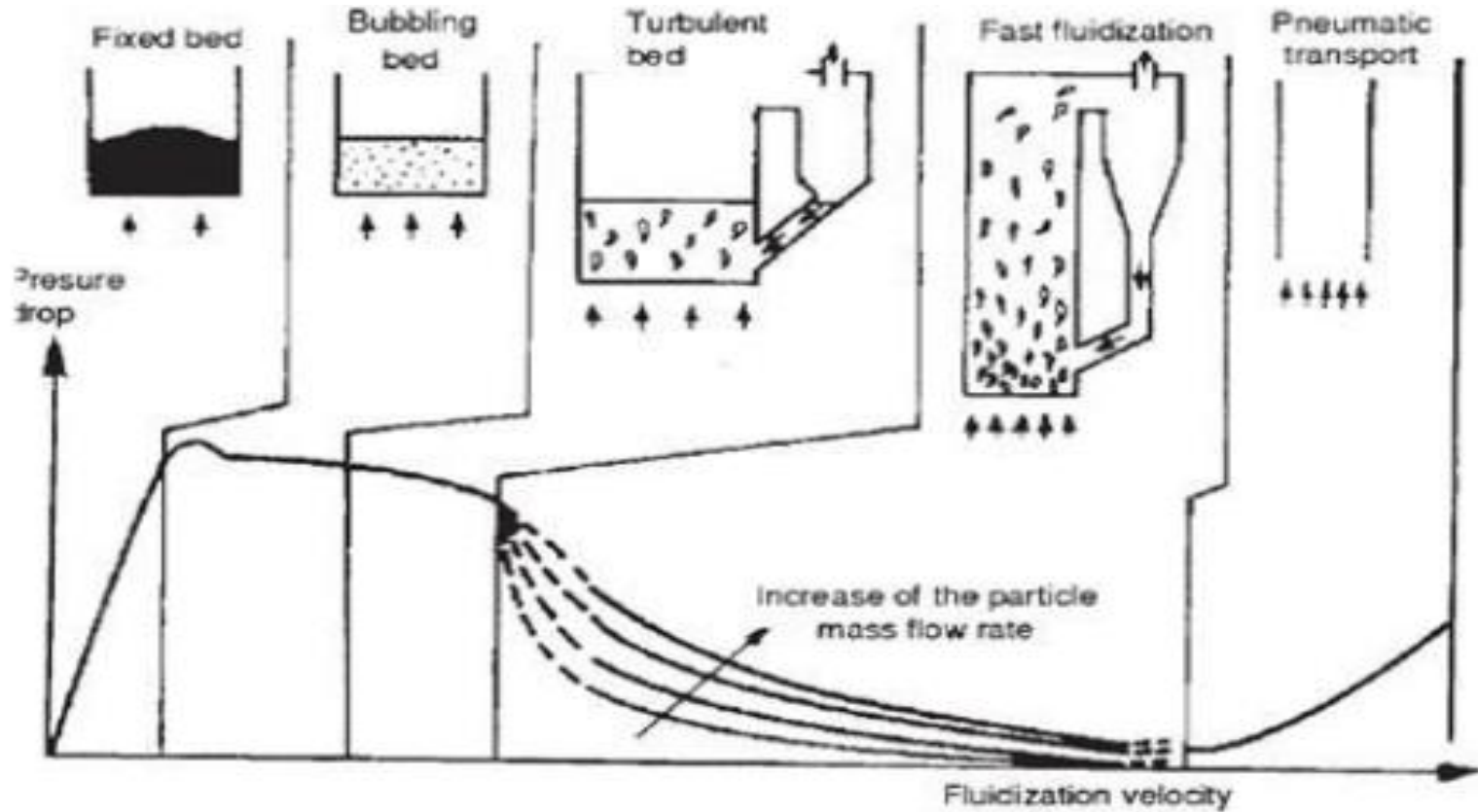
# Outline

- Introduction
- Mechanism of Fluidization
- Types of fluidized bed dryer



## Introduction

- Most powder-like products produced by spray drying or grinding are dusty, exhibit poor flow characteristics and are difficult to rehydrate. It is well known, however, that agglomeration in most instances will improve the redispersion characteristics of a powder.
- Added benefits of agglomerated powders are that they exhibit improved flowability and are non-dusting.
- All of these characteristics account for their increased demand in recent years.
- Depending on the application or industry where the process is being used, agglomeration is sometimes referred to as granulation or instantizing.



**Fluidization Regimes**



## Mechanism of Fluidization

Fluidized bed drying is generally used in combination with spray and roller drying, as a final drying procedure to bring the moisture of the powder down to the level required for storage stability. Fluidized bed drying is an integral part of instantization. It is also used for production of lactose and granular powders. The fluidized bed method is not only used for drying but also used for cooling any material which can be made to flow.



**Force of gravity acting on the bed:**

$$\Delta P = H_0 \cdot g (\rho_k - \rho_A) (1 - \psi_0)$$

**Where,**

**$H_0$  = depth of the bed of material at rest**

**$\rho_k$  = density of the individual particles**

$\rho_A$  = density of the air

$\psi_0$  = porosity of the bed at rest (usually  $\psi_0 = 0.4$ )

**The pressure drop of the gas on passing through the bed is:**

$$\Delta P = 64 (\mu_1 / \psi^2) \{ (1/Re) + (\xi_{\infty}/64) \} (H_0/d^*) (\rho_A/2) v^2$$

$\mu_1$  = factor due to increase in length of the path,  $\mu_1 = 0.75$  for beds

$Re$  = Reynold's number, composed of  $d^*$  and  $V \dot{\epsilon}_0 = v/\dot{\epsilon}_0$

$\xi$  = resistance coefficient for turbulent flow

$v$  = velocity of gas based on the cross section of empty tower

$d^*$  = the hydraulic diameter of the pores

The above equation is valid for laminar, transition and turbulent flow. Combining the two equations yields the velocity at which the bed starts to expand.



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Thank you