

Lecture

Powder Processing

Powder Compaction:

- packing of powder particles:
- packing fraction, # of powder contacts
integral for sintering.

→ Unisize spheres:

↳ during regular packing: → packing fraction
→ coordination no.

→ Regular structure:

i) Simple cubic → PF = 52%
→ CN = 6

ii) BCC → PF = 0.68 ; CN = 8

iii) FCC → PF = 0.74 ; CN = 12

→ No. of particles per unit bulk volume

$$N_p = \frac{6PF}{\pi D^3}$$

→ $N_c = \frac{CN}{2}$ → no. of particle contacts per unit volume.

$$N_c = \frac{3(PF)(CN)}{\pi D^3}$$

→ $PF \approx 0.6$ { for loose random packing }

$PF \approx 0.64$ { for dense random packing }

non-regular arrangements.

↳ above values for unisize spheres and μm range.

→ Powder particles of Alumina $[Al_2O_3]$

↳ Loose random packing $\Rightarrow PF = 0.3$

↳ packing fraction reduces due to agglomeration of nanosize powder spheres.

$$C_N = \frac{\pi}{(1-P_F)} \quad N_p = \frac{6PF}{\pi D^3} \quad N_c = \frac{3(PF)}{(1-P_F)D^3}$$