

where t_c is the circulation time (the time interval between two subsequent passages of a crystal through the impeller area), V_c is the total volume of the crystallizer, K_i is the impeller discharge coefficient, N_i is the impeller speed, and D_i is the impeller diameter.

Assuming that only the collisions with the tip of the impeller blade are effective, the impact energy E_L is proportional to the mass and the tip speed of the impeller:

$$E_L \propto m_L(ND)^2 \tag{1.5}$$

Then, the overall nucleation rate B is proportional to crystal-impeller collisions, K_{c-i} :

$$B \propto K_{c-i} \int_{L_{c-i}}^{\infty} \frac{KN^3 D^5}{V_c} m_L n_L dL \tag{1.6}$$

The power dissipated by the impeller per unit mass of suspension, ϵ , is defined as

$$\epsilon = \frac{P_0 N^3 D^5}{V_c} \tag{1.7}$$

By $m_L = \rho_c K_v L L^3$, equation 1.6 can be written as

$$B \propto K_{c-i} \frac{K_i}{N_p} K_v \rho_c \epsilon \int_{L_{c-i}}^{\infty} L^3 n_L dL \tag{1.8}$$

A detailed study of the model was performed by van Beusichem.⁷⁶

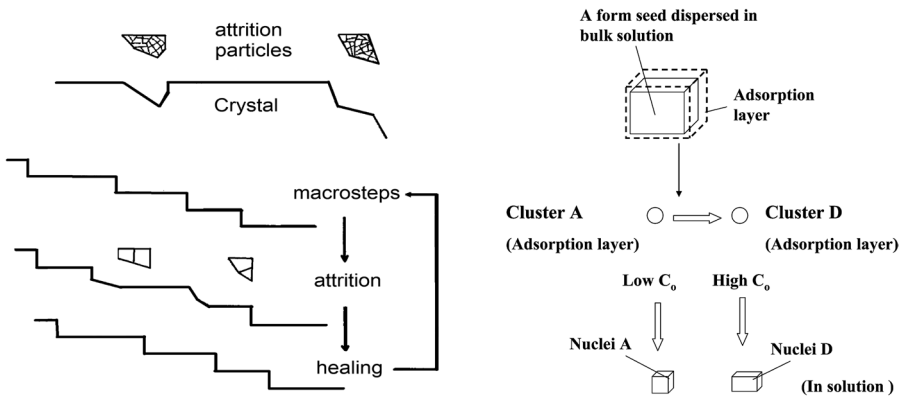


Figure 1.3 Attrition vs. contact and shear-secondary nucleation mechanism. Reproduced from ref. 77 with permission from Elsevier, Copyright 1994 and from ref. 78 with permission from American Chemical Society, Copyright 2016.