quantitative approach we choose ϱ to be constant in the range $-d \leq x \leq d$. Since for the total dislocation

$$\int_{-\infty}^{+\infty} b\varrho(x)\,dx = b$$

$\varrho(x) = 1/2d$ for $|x| < d$, and 0 otherwise, the centre of the dislocation being at $x = 0$. At x the absolute value of the Burgers vector defining the stacking fault is equal to

$$b(x) = \int_{-d}^{x} b\varrho(x)\,dx = b\frac{x+d}{2d}$$

for $|x| < d$ and 0 otherwise.

Thus between x and $(x + dx)$ we have a strip of stacking fault with the energy

$$\gamma[b(x)]\,dx = \gamma_o \cos^2(\pi x/2d)\,dx$$

for $|x| < d$.

The width d of this function defining the dissociation is obtained by minimizing the total energy with respect to d. This total energy consists of five contributions.

1. The energy of the stacking fault strips

$$\int_{-\infty}^{+\infty} \gamma[b(x)]\,dx = \gamma_o d$$

2. The interaction energy between partials which is about

$$-\left[\mu b^2/2\pi(1-\nu)\right] \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} dx\,dx'\,\varrho(x)\varrho(x')\log(|x-x'|/b)$$

$$= -\left[\mu b^2/2\pi(1-\nu)\right](\log(2d/b) - 3/2),$$

where μ is the shear modulus and ν the Poisson ratio.

3. The interaction energy between "Frank partials" due to the dilatation ε perpendicular to the fault. To get a rough estimate of this energy we assume that ε varies linearly from 0 for $x = \pm d$ to ε_o for $x = 0$. The interaction energy between Frank partials of the continuous distribution so introduced is then equal to

$$-\left[\mu \varepsilon_o^2 b^2/8\pi(1-\nu)\right](\log(d/4\pi) - 3/2).$$

The self-energy of the partials is $\mu b^2/2 \int_{-\infty}^{+\infty} \varrho(x)dx = \mu b^2/2$ for the first distribution and $\mu\varepsilon_o^2 b^2/4$ for the Frank partial distribution.

The work done against the external hydrostatic pressure p to produce the dilatation ε. With the linear approximation for ε in 3., this term is simply equal $\varepsilon_o bpd/2$.

Minimizing the sum of the preceding five contributions with respect to d we obtain the dissociation width

$$d = \frac{\mu b^2(1 + \varepsilon_o^2/4)}{2\pi(1-\nu)(\gamma_o + \varepsilon_o bp/2)}.$$

At $p = 0$ typical values of d/b are 8 and 6 for LiF and NaCl, respectively. It is clear from the last equation that a hydrostatic pressure p must have some effect when $\varepsilon_o bp/2$ becomes comparable to γ_o. To obtain an order of magnitude we define a critical pressure p_c such that

$$\varepsilon_o b p_c/2 = \gamma_o/10 .$$

Values of p_c are 6 kbar for LiF and 4 kbar for NaCl. Experimentally (3) no pressure effects are found for LiF at 4.3 kbar. At the same pressure effects are, however, detected for NaCl, and also for LiF tested at 13 kbar (3, 4) (observed is an increase in the flow stress and a decrease in dislocation mobility). Of course the agreement found here with our calculation must be considered to be only semiquantitative because of the arbitrary definition of p_c. At least it explains the observed difference between LiF and NaCl. On the other hand, the action of p results in narrower dissociated core, thus easier cross-slip which is difficult to associate to the observed increase in flow stress.

Finally such pressure effects can be expected in all cases where a dilatation occurs at stacking faults. For example in b.c.c. metals the 1/8 [110] (1$\bar{1}$0) fault produces a compression of the planes adjacent to the fault. These become closer b/39 as seen from hard spheres considerations (6). Thus hydrostatic pressure help dissociation markedly for $p \gtrsim p_c$. With $bp_c/39 \approx \gamma_o/10$ and with $\gamma_o = 0.0135 \mu b$ for iron (6), $p_c \approx 42$ kbar. As far as we know, experiments on iron single crystals under such high hydrostatic pressures have not yet been reported.