International Tables for Crystallography (2006). Vol. C, Figure 2.6.1.7, p. 95.

direction with a constant cross section of arbitrary shape (long cylinders, parallelepipeds, *etc.*) The cross section A (with maximum dimension d) should be small in comparison to the length of the whole particle L:

$$d \ll L \quad L = (D^2 - d^2)^{1/2} \simeq D. \qquad (2.6.1.40)$$

The scattering curve of such a particle can be written as

$$I(h) = L(\pi/h)I_c(h), \qquad (2.6.1.41)$$

where the function $I_c(h)$ is related only to the cross section and the factor $1/h$ is characteristic for rod-like particles (Kratky & Porod, 1948; Porod, 1982). The cross-section function $I_c(h)$ is

$$I_c(h) = (L\pi)^{-1}I(h)h = \text{constant} \times I(h)h. \qquad (2.6.1.42)$$

This function was used in the previous subsection for the determination of the cross-section parameters R_c, A, and M_c. In addition, we have

$$I_c(h) = 2\pi \int\limits_0^\infty p_c(r)J_0(hr)\,\mathrm{d}r, \qquad (2.6.1.43)$$

where $J_0(hr)$ is the zero-order Bessel function and

$$p_c(r) = \frac{1}{2\pi}\int\limits_0^\infty I_c(h)(hr)J_0(hr)\,\mathrm{d}h \qquad (2.6.1.44)$$

(Glatter, 1982*a*). The function $p_c(r)$ is the PDDF of the cross section with

$$p_c(r) = r\gamma_c(r) = \langle\Delta\rho(\mathbf{r}_c) * \Delta\rho(-\mathbf{r}_c)\rangle. \qquad (2.6.1.45)$$

The symbol * stands for the mathematical operation called convolution and the symbol $\langle\,\rangle$ means averaging over all directions in the plane of the cross section. Rod-like particles with a constant cross section show a linear descent of $p(r)$ for $r \gg d$ if $D > 2.5d$. The slope of this linear part is proportional to the square of the area of the cross section,

$$\frac{\mathrm{d}p}{\mathrm{d}r} = -\frac{A^2\Delta\rho^2}{2}. \qquad (2.6.1.46)$$

The PDDF's of parallelepipeds with the same cross section but different length L are shown in Fig. 2.6.1.6. The maximum corresponds to the cross section and the point of inflection r_i gives a rough indication for the size of the cross section. This is shown more clearly in Fig. 2.6.1.7, where three parallelepipeds with equal cross section area A but different cross-section dimensions are shown. If we find from the overall PDDF that the particle under investigation is a rod-like particle, we can use the PDDF of the cross section $p_c(r)$ to obtain more information on the cross section (Glatter, 1980*a*).

Flat particles. Flat particles, *i.e.* particles elongated in two dimensions (discs, flat parallelepipeds), with a constant thickness T much smaller than the overall dimensions D, can be treated in a similar way. The scattering function can be written as

$$I(h) = A\frac{2\pi}{h^2}I_t(h), \qquad (2.6.1.47)$$

where $I_t(h)$ is the so-called thickness factor (Kratky & Porod, 1948) or

$$I_t(h) = (A2\pi)^{-1}I(h)h = \text{constant} \times I(h)h^2, \qquad (2.6.1.48)$$

which can be used for the determination of R_t, T, and M_t. In addition, we have again:

$$I_t(h) = 2\int\limits_0^\infty p_t(r)\cos(hr)\,\mathrm{d}r \qquad (2.6.1.49)$$

and

$$p_t(r) = \gamma_t(r) - \frac{1}{\pi}\int\limits_0^\infty I_t(h)\cos(hr)\,\mathrm{d}h$$
$$= \Delta\rho_t(r) * \Delta\rho_t(-r). \qquad (2.6.1.50)$$

PDDF's from flat particles do not show clear features and therefore it is better to study $f(r) = p(r)/r$ (Glatter, 1979). The corresponding functions for lamellar particles with the same basal plane but different thickness are shown in Fig. 2.6.1.7(*b*). The marked transition points in Fig. 2.6.1.7(*b*) can be used to determine the thickness. The PDDF of the thickness $p_t(r)$ can give more information in such cases, especially for inhomogeneous particles (see below).

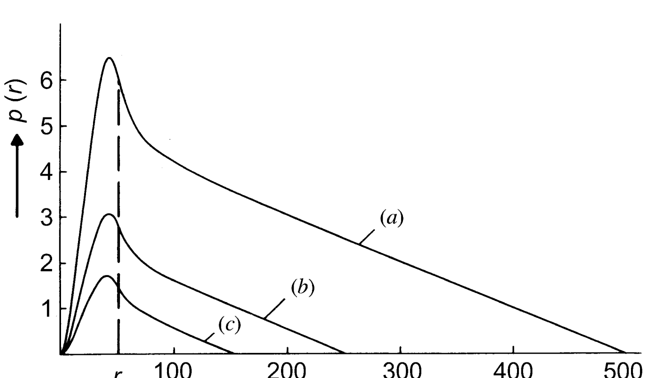

Fig. 2.6.1.6. Distance distributions from homogeneous parallelepipeds with edge lengths of: (*a*) 50 × 50 × 500 Å; (*b*) 50 × 50 × 250 Å; (*c*) 50 × 50 × 150 Å.

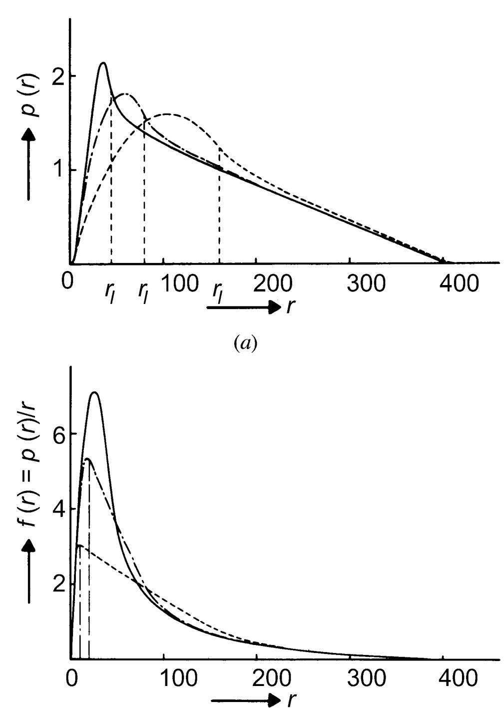

Fig. 2.6.1.7. Three parallelepipeds with constant length L (400 Å) and a constant cross section but varying length of the edges: ——— 40 × 40 Å; —·—·— 80 × 20 Å; - - - - 160 × 10 Å. (*a*) $p(r)$ function. (*b*) $f(r) = p(r)/r$.

references