Table 1. *Observed and corrected refraction displacements*

Reflexions	222	111	$\bar{1}\bar{1}\bar{1}$	$\bar{2}\bar{2}\bar{2}$	$1\bar{1}3$	$\bar{1}1\bar{3}$	204	$\bar{2}0\bar{4}$
Δ (mm.)	1·5	1·5	1·5	1·7	2·75	1·8	2·5	1·8
u (°)	25	30	35	40	50	−15	50	−30
$\Delta \cos u$ (mm.)	1·4	1·3	1·2	1·4	1·8	1·7	1·6	1·6
u_0 (°)	37				20		10	
$\delta=\Delta \cos u/\cos u_0$ (mm.)	1·55				1·85		1·60	
φ (radians)	8.10^{-3}				10^{-2}		8.10^{-3}	

curved, when the angle between **e** and the whisker axis is different from 90°.

As illustrated in Fig. 2, refraction will further shift the two spots in opposite directions, normal to the projection of the whisker axis. If the twist and bending are homogeneous, the refraction component, δ, of the separation can be calculated from the magnitude, Δ, and the direction, u, of the observed separations. Results are given in Table 1. u_0, the angles between the reciprocal-lattice vectors and the refraction displacement, correspond to the assumed average orientation, $[4\bar{2}\bar{2}]$.

The resulting δ is appreciable higher than the value 1·2 calculated from the Fourier coefficient $\bar{V}_0$ and the orientation $[4\bar{2}\bar{2}]$ assuming two-beam conditions.

From the measured curvature of the layer line and the bending ($\sim 2.10^{-2}/\mu$) observed in the micrograph, an estimated lower limit of the axial twist, $\sim 10^{-2}/\mu$, was obtained, corresponding to a Buergers vector of $\gtrsim$ 20 Å. The angular difference between the reflecting positions of the two sides can then be translated into an upper limit of the side-twist. We obtain $\alpha \sim 5.10^{-3}$ corresponding to $b \lesssim 25$ Å for a central dislocation.

As mentioned above, the diffracting parts of the two sides of a whisker, e.g. the parts corresponding to (111) having the orientations OA and OA' in Fig. 2, will have different positions along the whisker axis. In a low-magnification dark-field image from another, straight, whisker, such a position difference between the diffracting parts was actually observed. Assuming the axial twist to be b/d^2 and the side-twist to be b/d, the expected shift in position is readily found to be h_2/h_1 diameters, where h_1 and h_2 are the components of the diffraction vector along the normal to the whisker axis. The observed shift was nearly twice as large, indicating either a side-twist larger than b/d, as may be the case when the screw dislocation is non-central, or an axial twist lower than the theoretical value.

Some of the whiskers appeared to have even larger twist than the one described here, and streaking of the spots, as is visible in some of the reflexions in Fig. 1, was frequently observed, indicating some polygonization along the whisker, with block lengths of a few tenths of a micron and orientation differences of the order of 5.10^{-3}.

The lack of the usual dynamic splitting in two separate waves from each of the wedges is not fully understood. The implication is, of course, that the equal-thickness fringes from the crystal wedges have only slight contrast or irregularities in spacing so great that their Fourier representation by two components breaks down. The latter case may be realized through many-beam (discrete or continuous) interactions, but it appears more likely that the effect is directly connected with the mentioned lattice twist, which will cause the excitation error, ζ, for planes at an angle with the whisker axis, to vary with distance from the edge. By considering the argument $(\frac{1}{2}H(\zeta^2+V_h^2/k^2)^{\frac{1}{2}})$ of the pendulum solution (see e.g. Pinsker, 1953; H, ζ, V_h and k have their usual meaning) one finds that the lateral periodicity of fringe contrast may be appreciably disturbed for twists of the order $10^{-2}/\mu$ or more. Similar qualitative conclusions may be reached by studying the projected potential of a twisted crystal and applying the 'phase-grating approximation', which is known to predict the correct dymanic fine structure (Cowley & Moodie, 1961).

It should be noted that large dislocation densities in sodium–chloride whishers have been reported previously (Webb, 1960).

My thanks are due to Dr J. M. Cowley for suggesting this problem and for valuable advice. Financial support from the Commonwealth Scientific and Industrial Research Organization and the Royal Norwegian Council for Scientific and Industrial Research is gratefully acknowledged.

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Acta Cryst. (1962). **15**, 1046

Background intensity of electrons scattered from solids.[*]

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(*Received* 2 *January* 1962 *and in revised form* 26 *March* 1962)

It has been well established experimentally by various investigators, Hongo, Uyeda & Miyake (1961), Bauer (1962), and Kitamura (1961), that the background intensity of electrons scattered from solids does not vary as s^{-4} which is the case for electron scattering from gases. Various experiments have shown, in fact, that this scattering falls off anywhere from approximately s^{-2} all the way up to s^{-1} or higher. It is the purpose of this note to point out that in the limit of thin film thickness,

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[*] Contribution number 1045 from theChemical Laboratories of Indiana University.

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the experimental electron diffraction background scattering from various metallic films can be correlated quite well by the simple X-ray background approximation of Warren (1953). The available data would seem to indicate that the background depends in a fairly sensitive manner on the film thickness and in general as the film thickness increases, the background scattering falls off less rapidly and in fact, in some cases has been shown to actually increase with increasing value of the scattering variable s. It is interesting to note, however, that for film thicknesses less than 100 Å, the shape of the background intensity usually can be fitted with a theoretical background made up of thermal diffuse and inelastic scattering components only. This approach, of course, ignores multiple scattering effects which surely are important for thicker films and also ignores the effect of local heating by the electron beam although if one were able to measure the actual temperature of the film, this effect would presumably be taken care of by the theory. For the cases of gold, silver and aluminum, an approximate theoretical background intensity can be calculated by making use of Warren's (1953) simple expression for the thermal diffuse scattering intensity for the face-centered cubic powder case and the Bewilogua (1931) inelastic scattering factor. The approximate expression for the total background intensity adjusted by an arbitrary scale factor may be written as

$$B(s) = K\{4zS(s)/a_0^2 s^4 + f_e^2(s)[1 - \exp[-2M(s, t)]]\}\,, \quad (1)$$

where $S(s)$ is the Bewilogua inelastic scattering factor, $f_e(s)$ is the elastic electron scattering factor and $M(s, t)$ is the Debye (1914) temperature factor. Theoretical background intensities for electrons scattered from gold, silver and aluminum foils were calculated using the theoretical expression for the Debye temperature factor

$$M(s, t) = (3\chi^2 N/Mk)[\Phi(\chi) + \tfrac{1}{4}]s^2 = Bs^2, \quad (2)$$

where χ is Θ/T, Φ is the Debye function and Θ is the Debye temperature. The values of B for gold, silver and aluminum respectively were 0·00714, 0·00910 and 0·01088. The Thomas–Fermi–Dirac scattering factors of Ibers (1958) were used in the calculation of $B(s)$ in equation (1).

Table 1. *Comparison of theoretical and experimental backgrounds*

	Au		Ag		Al	
s	Exp.* $B(s)$	Theo. $B(s)$	Exp.† $B(s)$	Theo. $B(s)$	Exp.‡ $B(s)$	Theo. $B(s)$
2·67	6·06	7·18	4·48	5·09	1·55	1·92
3·09	5·57	5·70	4·01	3·89	1·24	1·26
4·37	4·36	3·81	2·86	2·42	0·67	0·50
5·12	3·72	3·32	2·28	1·99	0·46	0·37
6·73	2·66	2·57	1·57	1·45	0·22	0·22
6·90	2·57	2·50	1·52	1·43	0·21	0·21
7·56	2·27	2·23	1·25	1·27	—	0·18
8·02	2·09	2·09	1·14	1·14	—	0·16

* Lennander's (1954) Au 2 Foil (105*A*).
† Lennander's (1954) Ag 1 Foil (75*A*).
‡ Lennander's (1954) Al 1 Foil (140*A*).

In Table 1, a comparison of the values of the calculated background intensities, from equation (1), with those obtained experimentally by Lennander (1954) are presented. In each case, K was chosen so that the backgrounds matched at the largest value of s for which experimental data were available. In Fig. 1, a comparison between the theoretical and experimental values, multiplied by s^4, for gold is shown. It is clear from the decomposition of the total background intensity into the inelastic part and the thermal diffuse scattering part that the fact that the intensity fall-off is less rapid than s^{-4} is due almost entirely to the contribution from the thermal diffuse scattering.

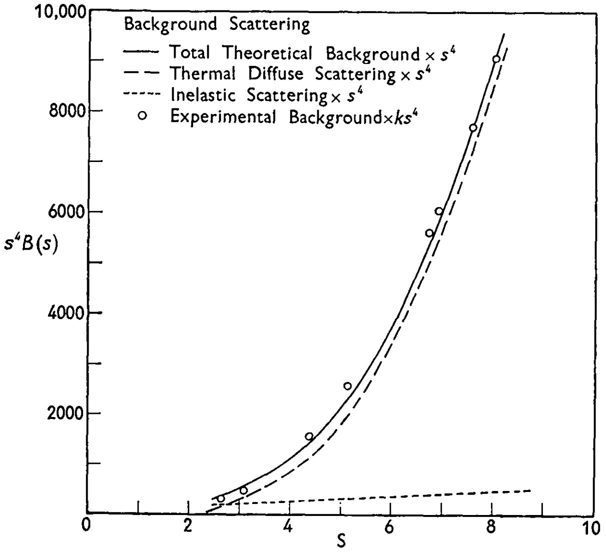

Fig. 1.

It is, of course, possible to obtain estimates of the temperature factors experimentally by reversing the above procedure. The results here indicate, however, that the theoretical and experimental temperature factors are in good agreement.

The author wishes to thank Dr J. Karle and Dr Hauptman for their encouragement and Dr Schoomer and Dr Norment for many helpful suggestions.

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