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ANOMALOUS CONTRAST FROM SHOCKLEY PARTIALS

P. C. J. Gallagher, J. Washburn and G. Thomas

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Inorganic Materials Research Division, Lawrence Radiation Laboratory,
and Department of Mineral Technology, College of Engineering
University of California, Berkeley, California

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In face centered cubic crystals intrinsic and extrinsic faulting
may readily be observed in low stacking fault energy materials and has
also been recognized in materials [1] for which the stacking fault
energy has a relatively high value, \( \sim 20 \text{ ergs/cm}^2 \). In the case of extrinsic-
intrinsic node pairs a cross-linking dislocation often forms leading
to the presence of a Shockley partial separating the intrinsically and
extrinsically faulted regions. Both node pairs and a new extrinsic-
intrinsic fault pair configuration, which also has a Shockley partial
separating the extrinsic and intrinsic faults, are described more fully
in [2], in which reference was made to contrast anomalies which arise
from such dislocations. Normally, Shockley partials (for which \( \mathbf{b} = 1/6 \ \langle 112 \rangle \)) are visible when \( \mathbf{g} \cdot \mathbf{b} = \pm 2/3 \) and invisible for \( \mathbf{g} \cdot \mathbf{b} = \pm 1/3 \),
where \( \mathbf{g} \) is the operative reflection [3]. As reported in [2], the Shockley
partial separating extrinsic and intrinsic faults is visible for \( \mathbf{g} \cdot \mathbf{b} = \pm 1/3 \) and invisible for \( \mathbf{g} \cdot \mathbf{b} = \pm 2/3 \).

Contrast anomalies also exist when Frank partials separate extrinsic
and intrinsic faults, and such a configuration arises in the double
faulted loops reported by [4]. Calculations for the latter case [5]
reveal that when allowance is made for the displacement vectors of the
fault and of the partial dislocation (\( \mathbf{b} \)) the phase factor determining
the contrast is \( \Delta \phi = 3\pi \mathbf{g} \cdot \mathbf{b} \) rather than the usual \( \Delta \phi = 2\pi \mathbf{g} \cdot \mathbf{b} \), and that the same result is also obtained in the case of a Shockley partial.

Complete experimental verification of this prediction has been obtained in the present work for the case of a Shockley partial separating extrinsic and intrinsic faults. The fault pairs A and B illustrated for five different reflecting conditions in Fig. 1 are of the type described in [2] and consist of three parallel Shockley partials of the same Burgers vector. In Table 1 the phase factors applicable to the center partial in each fault pair, \( \Delta \phi_A = 3\pi \mathbf{g} \cdot \mathbf{b}_A \) and \( \Delta \phi_B = 3\pi \mathbf{g} \cdot \mathbf{b}_B \), are listed. Background intensity is expected for \( \Delta \phi = 0 \) or \( \pm 2\pi \), and dark contrast for \( \Delta \phi = \pm \pi \) or \( \pm 3\pi \).

A comparison of Fig. 1 and Table 1 shows that in all cases the experimental results are in accord with the contrast calculated for a phase factor of \( 3\pi \mathbf{g} \cdot \mathbf{b} \).

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FIGURE CAPTION

Figure 1. Extrinsic-intrinsic fault pairs (A,B) observed under 5 different reflecting conditions.
REFERENCES

1. P. C. J. Gallagher and J. Washburn, to be published.


5. W. J. Tunstall and P. J. Goodhew, to be published.
Predicted and Observed Contrast for the Partials

Separating Extrinsic and Intrinsic Faults in Figure 1.

Foil Normal [110]  Faults in (11̅1) Plane  \( \Delta \phi = 3\pi \cdot \mathbf{g} \cdot \mathbf{b} \)

<table>
<thead>
<tr>
<th>Figure</th>
<th>( \mathbf{g} )</th>
<th>Fault Pair A(( \mathbf{b}_A = 1/6[12\bar{1}] ))</th>
<th>Fault Pair B(( \mathbf{b}_B = 1/6[21\bar{1}] ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>( \bar{1}11 )</td>
<td>( 2\pi ) background</td>
<td>( \pi ) dark</td>
</tr>
<tr>
<td>b</td>
<td>002</td>
<td>( \pi ) dark</td>
<td>( \pi ) dark</td>
</tr>
<tr>
<td>c</td>
<td>( \bar{2}20 )</td>
<td>( 3\pi ) dark</td>
<td>( 3\pi ) dark</td>
</tr>
<tr>
<td>d</td>
<td>( \bar{1}1\bar{3} )</td>
<td>0 background</td>
<td>( 3\pi ) dark</td>
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<tr>
<td>e</td>
<td>( \bar{1}13 )</td>
<td>( 3\pi ) dark</td>
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