By observing the reflexion of the light at a distance of several meters (we used a mark on the laboratory wall) one can readily achieve adjustment to within 0-05°. We could improve on this but our standard goniometer head did not allow us to make adjustments of less than 0-05°.

This use of the laser for alignment can also be adapted to crystal cutting equipment (alignment of a crystal face parallel to the circular saw). Accurate transfer of a crystal from the X-ray unit to the cutting equipment is facilitated. Finally, translation of the point of reflexion along the crystal face followed by rotation of the crystal provides a rapid means of checking the flatness of the face.

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A source of harmonic-free X-rays

Crystals of thiourea dioxide exhibit a number of reflexions which are essentially free of harmonic radiation because they have intense first orders and negligible higher orders.

It is sometimes useful to have a beam of X-rays which is intrinsically free of harmonic radiation and to produce such a beam by X-ray diffraction, a crystal is required with a strong first-order reflexion and higher orders of negligible reflecting power. A survey of published structure factor tables shows that this is a fairly uncommon occurrence. However, for thiourea dioxide (Sullivan & Hargreaves, 1962), there appear to be seven reflexions that satisfy this stringent condition: 011, 121, 131, 141, 151, 140 and 301.

The thiourea cell parameters were redetermined on a Picker diffractometer with Cu Kα radiation and the results obtained compare well with those of Hargreaves & Sullivan (given in parentheses): a = 10.116 ± 3 (10.13), b = 10.666 ± 3 (10.65), c = 3.920 ± 2 (3.92) Å.

The intensities of the 011 series of reflexions were remeasured with Mo Kα radiation and the results are given in Table 1. Assuming the intensity of bremsstrahlung radiation always to be less than 5% of the characteristic line intensity, the 011 diffracted beam will contain less than 0.02% harmonic content.

Table 1. Integrated intensities of the thiourea dioxide 0kk series of reflexions

<table>
<thead>
<tr>
<th>hkl</th>
<th>Integrated intensities</th>
</tr>
</thead>
<tbody>
<tr>
<td>011</td>
<td>3085 000</td>
</tr>
<tr>
<td>022</td>
<td>21 715</td>
</tr>
<tr>
<td>033</td>
<td>2 780</td>
</tr>
<tr>
<td>044</td>
<td>3 061</td>
</tr>
<tr>
<td>055</td>
<td>6</td>
</tr>
<tr>
<td>066</td>
<td>0</td>
</tr>
<tr>
<td>077</td>
<td>0</td>
</tr>
<tr>
<td>088</td>
<td>0</td>
</tr>
</tbody>
</table>

Thiourea is easily obtainable, crystallizes well from water, appears to be chemically stable and is not readily damaged by X-irradiation. It has a pronounced (100) cleavage plane and can be easily cut in any direction parallel to [010]. Crystals of this compound should therefore provide a simple means of producing harmonic-free X-ray beams.

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Reference

Meeting Report


Institute of Physics
Crystallography Group Meeting
Aberdeen, 13–15 April 1976

Once again the Crystallography Group decided to run its spring meeting with no specific title in order to encourage contributions on any aspect of crystallography. Papers devoted to ‘Advanced Techniques’ were particularly requested and these amounted to about half the final contributions. Nineteen papers were presented during a poster session. These were mainly concerned with structural determinations which are ideally suited to this style of presentation. The allotted two-hour session was substantially overrun as participants informally discussed detailed results with the authors.

The eighteen papers presented orally commenced with Baker (Harwell) describing his generalized approach to X-ray diffraction. As he pointed out, the basis of most diffraction experiments is the accurate measurement of the variation of X-ray intensity with angle. His system consists of a single base unit on which various attachments can be rigidly clamped to obtain the required experimental geometry. The whole is computer controlled, all necessary movements being made by stepping motors.

Glover (Cambridge) described how synchrotron radiation can be used for a variety of X-ray experiments. Direct comparison between experiments using a conventional X-ray source and experiments using synchrotron radiation is meaningless because of the widely different source outputs. Synchrotron radiation is most suited to energy-dispersive techniques as the beam is always highly parallel. The resulting fixed specimen position greatly facilitates experiments involving a variable specimen environment. The intensity available is extremely high, which can be exploited in fast X-ray topography and the study of biological materials which rapidly deteriorate.

Swindells (Liverpool) described how a focused electron beam of less than 5μm diameter can be used to generate Kossel Patterns. With this technique it is possible to find the orientation, structure and plane spacing of each crystallite of a multiphase metallurgical sample.

Three other papers dealt with specific experimental techniques. A group from Aberdeen described their experience with a hot stage and with a powder diffractometer. Johnson (British Steel) reviewed the use of focusing cameras—the ensuing discussion indicated that this is very much more of an art than a science. Faruqi (Cambridge) described his experience with position-sensitive detectors to study short-lived muscle fibres.

The remainder of the papers dealt with either materials investigations or methods of processing diffraction data. The range of materials studied was wide, as was the range of techniques used to study them. Bilsby and Ferguson (UKAEA) studied the corrosion films on zircaloy using X-ray diffraction, electron diffraction and Auger spectroscopy. Halliwel (Post Office) describes how multi-epitaxic gallium alu-