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Crystallographic angles for mercury, bismuth, antimony and arsenic. By D. J. Bacon, F. Heckscher and A. G. Crocker, Department of Physics, Battersea College of Technology, London, S. W. 11, England

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Crystallographic angles have been calculated for the metals mercury, bismuth, antimony and arsenic using a Ferranti Sirius Computer. These angles have been tabulated (Bacon, 1963). Some angles for bismuth have been published previously (Vickers, 1957) but tables of angles for the other metals do not appear to be generally available.* In the present work the structures were

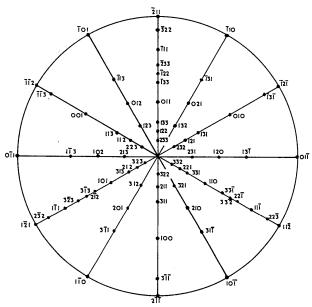


Fig. 1. Standard [111] stereographic projection for directions in mercury.

* Arko, Cotner & Weertman have recently calculated angles for mercury, using Miller indices in the range $\overline{4}$ to 4 referred to the primitive cell.

referred to face-centred rhombohedral cells, the axial angles used being 98° 21.8′ for mercury (Barrett, 1957) and 87° 32.4′, 87° 25.4′, 84° 38′ for bismuth, antimony and arsenic respectively (Wyckoff, 1960). Relations between the Miller indices given relative to these cells, and those referred to the alternative primitive rhombohedral and hexagonal cells are given elsewhere (Buerger, 1942).

Angles were calculated between planes and planes, directions and directions and plane normals and directions for Miller indices in the range $\bar{3}$ to 3 giving over 50,000 angles in all. A selection of these is given in degrees in Table 1. Although the structures of the metals are close to cubic the deviation from orthogonality can result in considerable differences between the three sets of angles for each metal. Only the [111] direction and directions contained in the (111) plane are perpendicular to planes with the same indices.

A standard [111] stereographic projection for directions in mercury is given in Fig. 1. Similar projections for planes in mercury and planes and directions in bismuth, antimony and arsenic may be constructed from the information contained in the table.

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Table 1. Table of crystallographic angles

	Angles between planes and (111) plane				Angles between directions and [111] direction			
	$\widetilde{ m Hg}$	Bi	Sb	As	$\widetilde{ m Hg}$	Bi	Sb	As
111	0	0	0	0	0	0	0	0
$\overline{2}11$	90	90	90	90	90	90	90	90
$\overline{3}22$	79.810	$82 \cdot 437$	$82 \cdot 459$	82.955	83.651	81.434	$81 \cdot 409$	80.807
Ī11	65.803	71.638	71.688	$72 \cdot 831$	74.455	$69 \cdot 364$	69.309	67.973
$\overline{2}33$	54.285	$62 \cdot 028$	$62 \cdot 097$	$63 \cdot 695$	66.007	58.929	58.855	57.084
$\overline{1}22$	48.054	56.422	56.499	58.287	60.910	53.014	52.933	51.021
$\overline{1}33$	41.674	50.313	50.396	$52 \cdot 318$	55.184	46.727	46.643	44.674
011	29.090	36.986	37.067	38.979	41.946	33.579	33.501	31.713
133	17.636	23.286	23.347	24.815	$27 \cdot 183$	20.774	20.718	19.448
122	12.546	16.766	16.812	17.935	19.773	14.871	14.830	13.883
233	7.918	10.664	10.694	11.436	$12 \cdot 663$	9.423	9.396	8.782
322	9.032	12.144	$12 \cdot 179$	13.018	$14 \cdot 401$	10.740	10.709	10.012
211	15.545	20.636	20.691	22.028	$24 \cdot 197$	18.363	18.312	17-169
311	23.993	31.071	$31 \cdot 145$	32.916	35.715	27.972	27.903	26.305
100	48.054	56.422	56.499	58.287	60.910	53.014	52.933	51.021
$3\overline{1}\overline{1}$	77.337	80.577	80.604	$81 \cdot 218$	$82 \cdot 082$	79.336	79.306	78.564
$2\overline{1}\overline{1}$	90	90	90	90	90	90	90	90
231	17.808	23.502	23.563	25.041	27.423	20.971	20.915	19.634
120	32.718	41.013	41.096	43.056	46.061	$37 \cdot 472$	37.391	35.508
$13\overline{1}$	$52 \cdot 106$	$60 \cdot 105$	$60 \cdot 177$	61.847	$64 \cdot 274$	56.885	56.808	54.979
$01\overline{1}$	90	90	90	90	90	90	90	90