α-silicon nitrides may not require oxygen at all. This conclusion, based on measurements on porous, reaction-bonded silicon nitride, is similar to that reached by Priest *et al* from measurements on dense, chemically vapour deposited α-silicon nitride.

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Complete indexing of electron diffraction patterns by computer

As electron microscopy is extended beyond the simple structures of metals to the more complex crystal structures of other materials, the difficulty of indexing electron diffraction patterns increases. In particular with lower symmetry structures, as found in some minerals for example, many similar but not identical diffraction patterns occur. In such cases it is important to be aware that several, non-equivalent indexing systems may fit a particular pattern within the limits of measuring accuracy. It is difficult for an operator to ensure that all possible systems have been taken into account. Such a situation is an obvious opportunity to apply a computer assisted analysis and a program has already been developed [1] which lists all possible diffraction patterns (i.e. distances and angles between them) for any given structure up to a beam direction [5 5 5].

However, in cases where only a few reflections occur from a particular specimen, it would be desirable to index the pattern directly by computer without having to complete a network of reflections from those few available. A new program has been developed which does index directly and is now available on request from the author.

The main difficulty in such a program is in the treatment of the errors. These are of two kinds: (a) an error in the camera constant (λL) due to variation in foil position and depth, (b) an error in detecting the correct position of a reciprocal lattice point from an observed reflection. The second error is not simply a result of measuring error, it arises because the reflection from a thin foil is always streaked in the direction of the foil normal (Fig. 1) and the reflection is observed at the point where the reflecting sphere intersects the streak rather than at the centre of the reflection streak which would be the true reciprocal lattice point. Operators often measure a whole row of reflections and divide by the number of intervals between points in the hope of increasing measuring accuracy. As Table I shows, such hope is illusory. In the case of planar faulted structures, with the faults lying at an angle to the foil

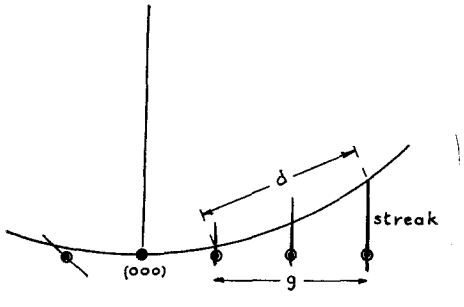

Figure 1 The intersection of the reflecting sphere with streaked reciprocal lattice reflections. The distance, d, measured on the diffraction pattern is different from the reciprocal lattice vector magnitude, $\mathbf{g}$. A spot streaked obliquely due to faulting, is also shown on the left.

TABLE I The output of an indexing system from the program. The first column gives the measured distances, R, on the diffraction pattern, the next column gives the reciprocal lattice vector, g, corresponding to R using the given λL value. g_{calc} gives the corresponding vector magnitude from the reciprocal lattice, which is followed by the Miller indices of the corresponding plane in the direct lattice. The next column gives the difference ($g - g_{calc}$) and is followed by the λL value deduced from g_{calc}. This gives an idea of the measuring errors for the three R values, in the scatter in λL. Finally the angles measured and calculated are listed, together with an identifier, e.g. (1-2) means the angle between the first and second R.
Given $\lambda L = 14.4 \pm 2\%$

R	g	g_{calc}	Indices			$g - g_{calc}$	λL	Angle	
								Measured	Calculated
1.70	0.118	0.1194	1	−1	0	0.001	14.24	103.2	104.1 (1-2)
2.80	0.194	0.1959	−1	0	1	0.001	14.29	69.0	69.6 (1-3)
2.91	0.202	0.2024	0	1	1	0.000	14.38	34.4	34.8 (2-3)

plane, the problem is even worse, since the reflections are then streaked obliquely across the plane of the pattern and the reflection may occur well away from the reciprocal lattice point. To improve this situation, operators should tilt the foils to the position where the intensity of the reflection is maximized before recording the pattern in such cases.

In the program described here, the operator is required to indicate error limits for both types of errors and the output gives an estimate of the actual error found. The two types of error are used differently since one (λL) behaves as a uniform scaling factor for the whole pattern while the other varies from one reflection to the next.

The program itself is included in a booklet which gives full details of its operation. It is written in standard (ANSI) Fortran and uses a method of computation described previously [1]. The user provides three (or fewer) measured distances to reflections on the pattern and the angles between them. The camera constant and the two error limits are also required. The program uses these data to produce three reciprocal lattice vectors which are then compared for size and for the angles between them, with the three-dimensional reciprocal lattice obtained from the structural data provided by the user.

When a suitable fit to three co-planar vectors has been obtained, the output produced is shown in Table I. The search is then continued until all possible indexing systems have been output.

In the event of a failure to index a pattern to the given structure ample fault messages are given to explain why. The efficiency of the computation is indicated by the fact that the CDC 7600/ICL 1906 combined machine at Manchester completes a single indexing in 0.25 sec.

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Lead-induced discontinuous precipitation in Fe-Au

In a recent review, the phenomena that occur in connection with discontinuous precipitation were discussed systematically [1]. It was noted that heat-treatments in specific environments may induce discontinuous precipitation in alloys which do not normally exhibit this reaction for any alloy compositions or ageing temperatures. In the following, this effect will be substantiated by reporting results on the precipitation reactions which occur in Fe-Au alloys aged in liquid Pb.

The system Fe-Au is characterized by a miscibility gap between the bcc or fcc iron-rich and the fcc gold-rich solid solutions. Fcc gold particles may be nucleated heterogeneously at dislocations or homogeneously in the supersaturated α-Fe-Au solid solutions [2, 3]. The