Bicrystals

TABLE

Threshold No. of Laue spots	% Missorts Bicrystals or maccles	Average with bicrystals and maccles	Average without bicrystals or maccles
18	92	33	26
19	92	27	20
20	88	21	15
21	88	17	11
22	88	17	10
23	88	19	12
24	88	21	14
25	76	23	17

The "average with bicrystals and maccles" includes the high missort averages for bicrystals, which will be sorted as maccles. In practice, this is not important as the bicrystals can be sorted from the maccles with an automatic shape sort, using for instance the machine disclosed in EP-A-O 227 404.

EXAMPLE 2

The whole volume of a diamond was scanned using a narrow beam; a stepper motor was used to move the stone. The stone was not pre-orientated. Graphs were drawn, based on the photographs, giving the pattern type for the two misorientated volumes A and B, as follows:

A—Strong pattern A
B—Strong pattern B
a—Weak pattern A
b—Weak pattern B

and the axes of the graphs represent stepper motor position in the x and y directions.

Maccled stones were distinguished from non-maccled stones by looking for a change in the observed pattern while displacing the stone relative to the beam until the whole volume of the stone had been exposed (see the description of FIGS. **11***a* to **11***c* above); this also gives information regarding the position of the misorientated volumes. The first frame of images is used as a reference frame and the later frames are examined for spots in different positions. If the boundary plane is inclined relative to the axis of the X-ray beam, the original spots will weaken and new spots gradually appear as the boundary plane is crossed—in general, the intensity of a Laue spot depends on the thickness of the region giving rise to the spot.

In transmission, the normal zirconium filter in the X-ray generator can be removed to generate more short-wave radiation and reduce Polariod exposure times to 10 seconds.

The present invention had been described above purely by way of example, and modifications can be made within the spirit of the invention. The invention also consists in any individual features described herein or any combination of such features or any generalisation of such features or combination.

I claim:

1. A method of determing the existence of misorientation in a crystal, comprising irradiating the crystal with a beam of substantially parallel incident X-rays without pre-orientating any crystallographic plane of the crystal with respect to the axis of the beam, imaging X-rays received from the crystal so as to cause a plurality of effectively angularly-separated images to be formed, the energy of the X-rays being such that while carrying out the method at least some of the X-rays forming the images have intersected the whole depth of a portion of the crystal being examined, and determining the existence of any misorientation from the images.

2. The method of claim **1**, comprising determining which images come from a first volume of the crystal having a first orientation, and which images come from a second volume, if any, of the crystal having a second, different orientation, and thereby determining the existence of misorientation.

3. The method of claim **1**, comprising determining the total number of images and comparing this number with a predetermined number representative of a single non-twinned crystal or of a twinned crystal or polycrystal.

4. The method of claim **1**, wherein at least one parameter of the images is detected, and peaks in the distribution of the parameter are determined, each peak representing a volume of different orientation.

5. The method of claim **1**, wherein the X-rays are imaged adjacent the axis of the incident X-rays, and the existence of any misorientation is determined from those images within a predetermined angle to the axis.

6. The method of claim **1**, which is repeated with the crystal in a different orientation relative to the axis of the X-rays.

7. The method of claim **1**, wherein shapes of individual spots are compared with projections of the whole cross-section of the crystal.

8. The method of claim **1**, wherein it is determined from the images whether there is a spot having a size corresponding to a projected size of the whole cross-section of the stone.

9. The method of claim **1**, wherein the X-ray beam is large enough to irradiate the whole crystal simultaneously, and the whole crystal is placed within the beam.

10. The method of claim **1**, wherein the X-ray beam is not large enough to irradiate the whole crystal simultaneously.

11. The method of claim **10**, wherein the crystal or a portion thereof is irradiated by scanning.

12. The method of claim **11**, wherein any change in the pattern of the images as scanning proceeds, is determined.

13. The method of claim **12**, in which the position of a second volume of the crystal which has a different orientation from that of the first volume of the crystal, is determined from the location of the scan at which the change occurs.

14. The method of claim **1**, wherein said images are formed of X-rays transmitted through the crystal.

15. The method of claim **1**, wherein said images are formed of X-rays back-reflected from the crystal.

16. The method of claim **1**, wherein a signal is provided indicative of the misorientation in the crystal using automatic image processing and analysis.

17. The method of claim **1**, wherein the X-rays are polychromatic.

18. Apparatus for determining the existence of a misorientation in a crystal, comprising:

means for irradiating the crystal with a beam of substantially parallel X-rays of such an energy that the X-rays penetrate at least half way through a portion of the crystal being examined;

means for mounting the crystal without pre-orientating any crystallographic plane of the crystal with respect to the axis of the X-rays;

means for imaging X-rays received from the crystal to thereby form a plurality of effectively angularly-separated images; and

means for examining said images to thereby determine the existence of any misorientation.

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