The following sixteen abstracts of papers are the first part out of sixty-seven papers read before the semi-annual meeting of the Institute on June 5th and 6th, 1953.

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1. Crystal Structure Analysis of the "Trigon" Particles of Colloidal Gold by a Three-Stage Electron Microscope

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When a dilute acidic solution of auric chloride is reduced by salicylic acid, very thin flaky single crystals grow up in it. The authors called them "Trigon" particles

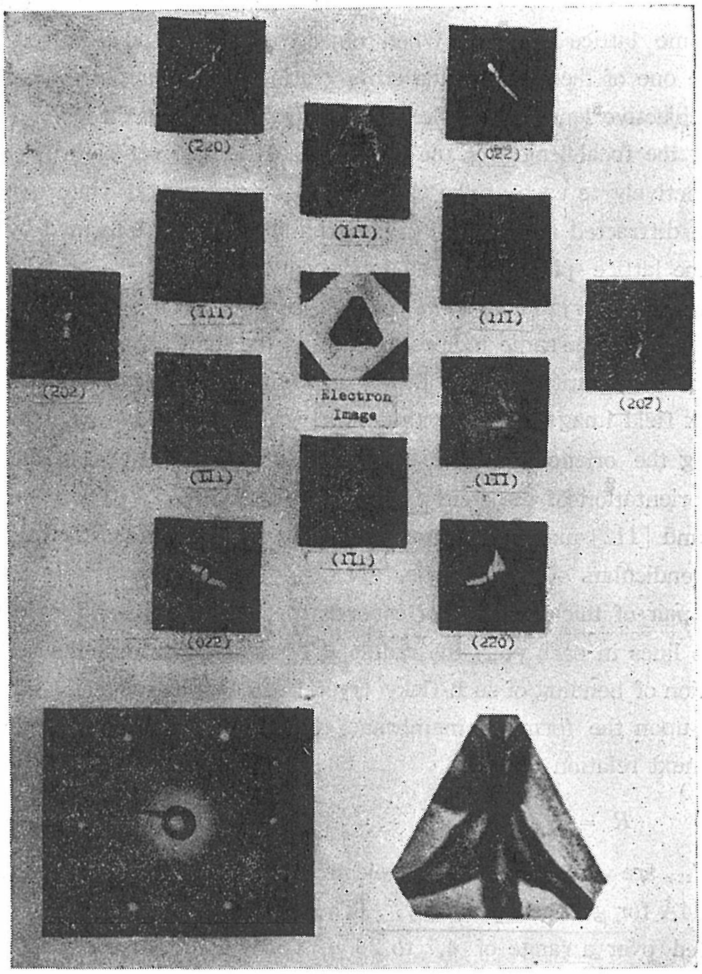

Fig. 1. A set of dark field images (upper), of the "Trigon" particle of gold sol (right) and its cross-grating pattern of electron diffraction (left), obtained by a three-stage electron microscope.

of gold sol, as they had a trigonal axis of symmetry like those obtained by H_2O_2 solution as reducing agents under acidic condition, though the average value of particle size for the former one is much larger than that of the latter (This Bull. **29**, 78, 79 (1951)). Many varieties of the crystal forms could be observed in the electron micrographs and various types of peculiar patterns could be seem on the flat surfaces of the crystals. One of these is shown in Fig. 1, which was obtained by a three-stage electron microscope (JEM-4) with an intermediate diaphragm by which a portion of the visual field can be selected and limited. By changing the focal length of the intermediate lens, an electron diffraction pattern of the very portion can be obtained directly without any disturbance to the specimen. On the other hand, these peculiar stripes, often observed on such flaky crystals, are considered to be caused by the diffraction effect of electron at the portion where the Bragg condition is partially satisfied by some lattice planes. When objective diaphragm is moved aside to the position where one of the spots of the cross-grating pattern appears on the back focal plane of the objective lens, and dark field electron image of the crystal was formed by readjusting the focal length of the intermediate lens, a set of bright lines corresponding respectively to each of the stripes seen on the crystal were obtained, which shows that the diffracted spots in the cross-grating pattern are formed by the electron reflected by the lattice planes included in the dark stripes of the bright field electron image. A set of Miller indices (*hkl*) can be given to each of these spots, and it is again possible to give the same indices to each of the dark stripes where the existence of the lattice planes, satisfying the Bragg condition, was suggested. By arranging the set of dark field images around the ordinary electron image as shown in Fig. 1, and by taking the orientation of the direction of these stripes in the crystal into account, the orientation of the zone axes can be determined. The results show that $[\bar{2}11]$, $[1\bar{2}1]$ and $[11\bar{2}]$ axes pass through the flat surface in the direction parallel to the three perpendiculars of the triangle.

The each pair of thick stripes corresponds to {220} planes, and from the intervals l of these two lines in each pair, the radius R of the curvature of the bending crystal, and the direction of bending of such flaky crystal can be determined. The flaky crystal is convex upon the formvar membrane, used as the specimen holder, and R is given by the next relation :

$$R = l \cdot d_{220}/\lambda ,$$

where λ and d_{220} are wave length of the electron and the interplanar distance of (220) planes (d=1.44Å for gold) respectively. The evaluation showed that the values of R is distributed over a range of 4.7 to 28 μ. (See, *Proc. Japan Academy*, **29**, 324) (1953)).