curve should pass through an x value of 0.05 (where a typical member of the hematite-ilmenite series can be written as x $FeTiO_3$, $(1-x)$ Fe_2O_3. This would imply a slight modification of the solidus curve determine by Uyeda.

DISCUSSION

S. OGAWA: Is there no any temperature difference between the surface and the thermocouple position?

M. BLACKMAN: While I would not wish to insist on the accuracy of our Curie point determination, the specimen was very well surrounded by the furnace and independent tests showed that the thermocouple readings were reasonably accurate. However, the real interest lies in the differential Curie point measurements and for these the accuracy of the thermocouple measurements is not really important.

JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN VOL. 17, SUPPLEMENT B-II, 1962
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON MAGNETISM AND CRYSTALLOGRAPHY, 1961, VOL. II

An Electron Microscope Capable of Simultaneous Recording of an Electron Microscopic Image and an Electron Diffraction Pattern

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A new device of the three-stage electron microscope capable of simultaneous recording of an electron microscopic image and an electron diffraction pattern is explained and an example of transformation due to heating of an evaporated film of Al 50 wt.%/Cu 50 wt.% alloy is shown.

It is well-known that we can obtain, by means of a three-stage electron microscope, an electron microscopic image and an electron diffraction pattern from a thin film specimen by varying the strength of the intermediate lens. Recently, an electron microscope with a cine-camera has been developed and the continuous recording of a transformation which occurs in a crystalline specimen by heating, cooling, or tension, etc., has become possible. But, in such an apparatus, it is difficult to observe an image and a diffraction pattern simultaneously, and either an image or a diffraction pattern is recorded alternately. On the way of the transformation it is quite impossible to know to which crystallographic stage the image under observation corresponds. The important advantage of the three-stage electron microscope is partly lost in such an apparatus. In order to cover this defect, we have designed an electron microscope permitting the simultaneous recording of an image and a diffraction pattern.

Fig. 1 is a block diagram showing the cinematographic apparatus 4 attached to a three-stage electron microscope. The strength of the intermediate lens is varied respectively by means of the two regulators 22 and 23, corresponding to the half-rotation of the cam 16 interlinked mechanically with the shutter 5 of the cine-camera 12. Fig. 1 (b) and 1 (c) show the path of the electron beam corresponding to the image and the diffraction pattern respectively.

In the state of Fig. 1(a), the intermediate lens is excited so as to produce an image 20, that is, the exchanging switch 14 is closed by the rotation of the cam and the current of the lens is controlled by the regulator 22. The ratio of the number of teeth of the gears 17 and 18 is 2: 1, so that, at the next moment after the half rotation of the cam from the state shown in Fig. 1 (b), the switch 15 is closed and the strength of the intermediate lens is varied so as to produce the diffraction pattern corresponding to Fig. 1 (c). Of course, this half rotation causes one rotation of the gear 18 which advances one exposure of the film

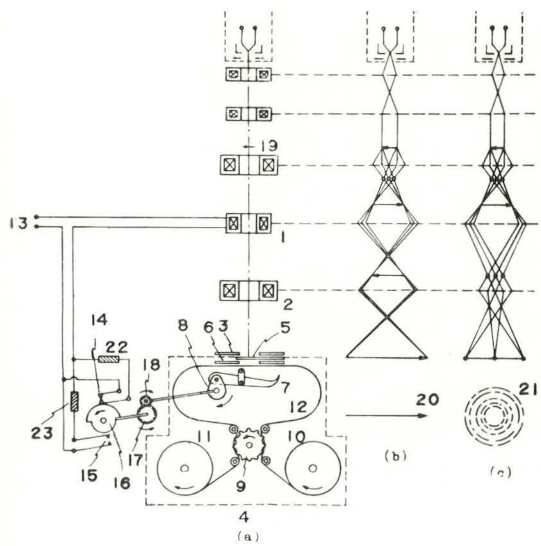

Fig. 1.

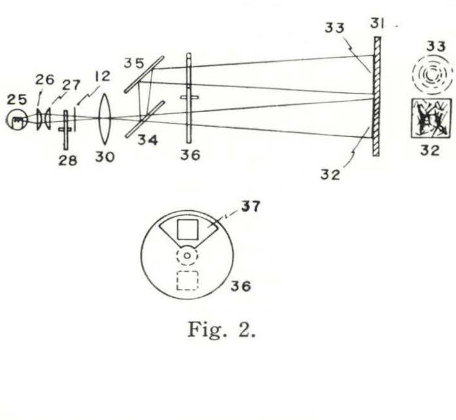

Fig. 2.

10 by means of the crank 8. The transient unstable state of the electron beam produced by the rapid change of the current of the intermediate lens is screened by the shutter 5 and a stable image is recorded on the film through the aperture 6. Thus, the image and the diffraction pattern produced by the successive opening and closing of the switches 14 and 15 interlinked mechanically with the motion of the crank 8 are recorded reciprocally on the film as shown in Fig. 3.

Fig. 2 is a block diagram showing the projector by means of which we observe side by side separately the continuous changes of images recorded reciprocally on the film by the above-mentioned electron microscope. In order to separate the image and the diffraction pattern of the film, we set mirrors 34 and 35 and a separation shutter 36. The mirror 34 is semi-transparent, while the mirror 35 is not transparent; both are inclined to the optical axis of the projector by 45°. On the screen 31 are projected side by side two images 32 and 33 separated by the mirrors 34 and 35 as shown in Fig. 2. The separation shutter is circular and a window 37 is perforated on the disk, which prevents each image from superposition of the other. For example, at the moment when the reflected light from the mirror 35 passes through the window 37, the light from the mirror 34 is stopped. The rotation of the separation shutter is interlinked with the advancement of the film.

Fig. 3 shows an example of the recording carried out by the present electron microscope. The specimen is an evaporated film of Al 50 wt.%/Cu 50 wt.% alloy which shows an interesting transformation by heating[1]. The order of the transformation is:

Initial stage→$CuAl_2$→$CuAl$→Cu_9Al_4→Cu_3Al.

Fig. 3 (a) shows the initial stage of this specimen. By heating in the interior of the electron microscope, many crystallites of the phase $CuAl_2$ appear (Fig. 3(b)) and they grow larger by further heating (Fig. 3 (c)). The phase Cu_9Al_4 appear in Fig. 3 (d) and the transition to the next stage Cu_3Al is recognized in Fig. 3(e). The transformation is clearly shown by electron microscopy and electron diffraction separately; even on the way of the transformation the crystallographic analysis is possible.

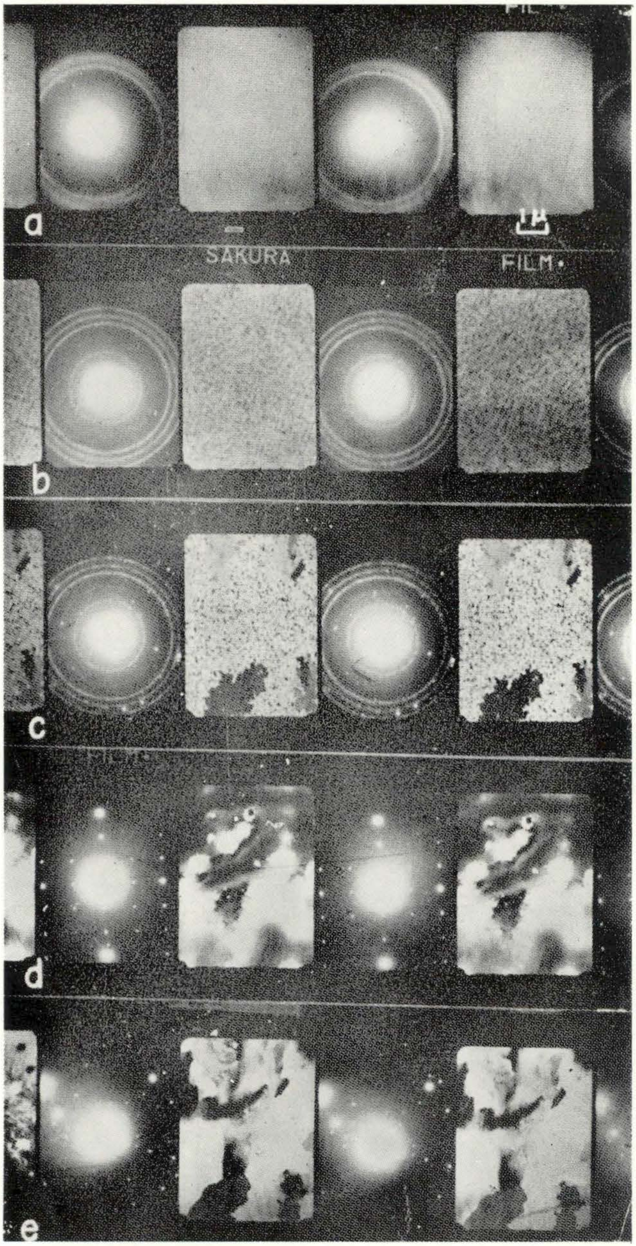

Fig. 3.

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