where β is the ratio of electron velocity to light velocity. This formula can be driven from that of δ_c by taking $C_c=5$ mm, $d_{200}=2$ Å and $\Delta E=19/\beta^2$. This means that the width of the continuous spectrum is roughly proportional to β^{-2} for thin specimens of about 300 Å thick used in the present experiment.

It is worth noting that not only the quality of dark field images is improved at higher voltages, but also the intensity of images increases quickly with the rise of the voltage. At 50 kV, (200)-images could be taken easily but (220)-images were difficult to focus due to the lack of intensity. At 100 kV, (220)-images were easy but (400)-images were difficult, etc. Figure 12 shows the limit of reflection order, below which the images can be taken without serious difficulties. The increase of the intensity of the high order reflections is due to the relativistic effect which results in the effective increase of the structure facter. Figure 12 shows the improvement of image quality with the accelerating voltage, too. The quality of bright field images is essentially the same at 100 kV and 800 kV. However, that of dark field images is improved remarkably with the rise of the accelerating voltages as already described.

C. *Resolution limits on α-E diagram*

It has been made clear that the resolution of dark field images of thin specimen is limited by the following three factors: (1) Apparent astigmatism due to the spherical aberration $d_{\min}=1\times10^5\alpha^2$, (2) shift of the image due to the characteristic loss $l_c=1.3\times10^9(\gamma/E)\alpha$ and (3) streak due to the continuous loss $l_s=7.5\times10^8\gamma\alpha/(E\beta^2)$. The latter two are due to the chromatic aberration.

In Fig. 13 the deflecting angle α for various reflections are drawn by taking as abscissa the accelerating voltage. If $d_{\min}$, l_c and l_s are assumed to be the same value, say 25 Å, the relation between the α and E can be calculated for each of $d_{\min}$, l_c and l_s. They are drawn with dotted curves. Below all of these three curves, the resolution is better than 25 Å. Figure 13 is very useful to know the upper limit of the reflection order below which the images of prescribed resolution is obtained.

Dark field images of good quality with resolution better than 25 Å cannot be taken below about 400 kV. Good quality images

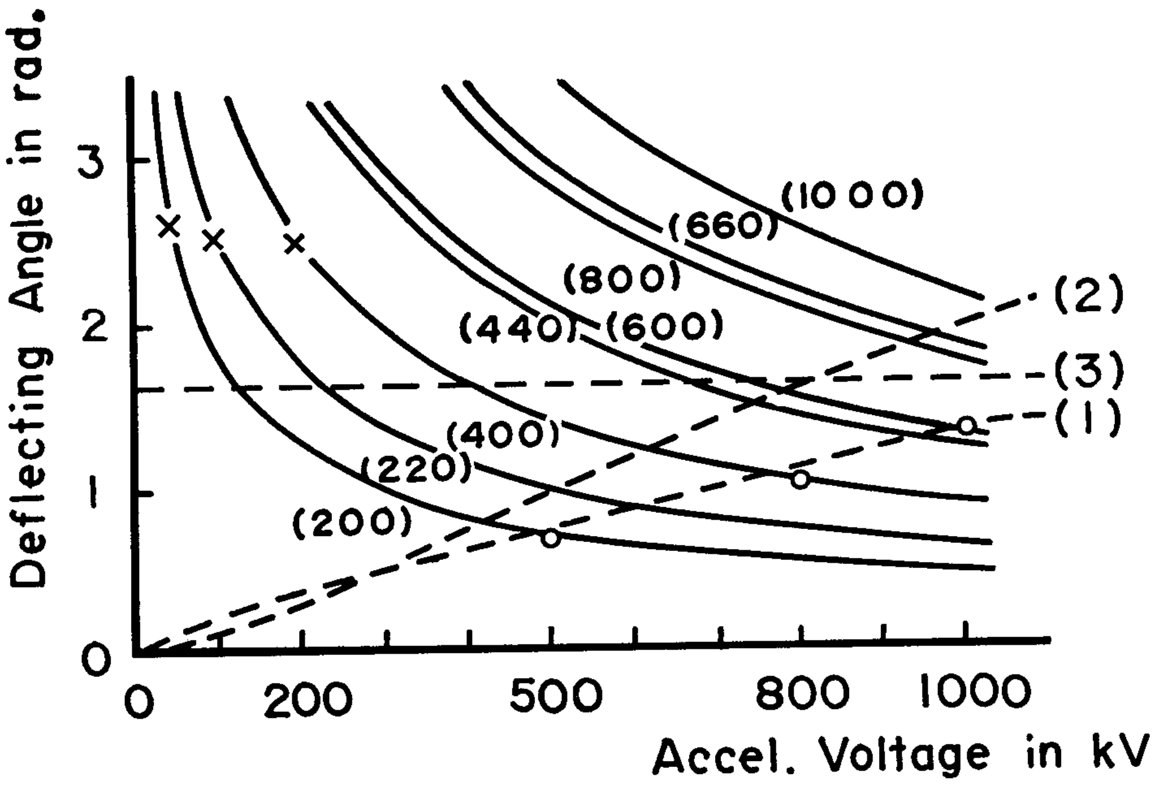

Fig. 13. Changes of deflecting angles with the accelerating voltages. The dotted curves show the calculated limits under which the resolution is better than 25 Å. (1): l_c, (2): l_s and (3): astigmatism. Marks O indicates the point where the resolution of about 25 Å is experimentally obtained. Marks × show the points where the quality of observed images are nearly the same.

can be taken only with (200) at 500 kV. They can be taken with (200), (220) and (400) at 800 kV and with (200), (220), (400), (440) and (600) at 1000 kV. It was demonstrated in the experiment that the quality is roughly the same for (200)-images at 500 kV and (400)-images at 800 kV.

Summarizing the results of the present experiment, it can be concluded that one of the most important merits of the high voltage electron microscopy is that the good quality dark field images can be taken without the complicated adjustment of inclining the incident beam. This is most convenient for determination of Burgers vector because images with several reflections are necessary for this. It should also be added that 1000 kV is much superior than 500 kV when dark field images with high order reflections are needed.

Acknowledgement

The author expresses his sincere thanks to Prof. R. Uyeda for his guidance and encouragement throughout this work. Thanks go also to Dr. Y. Kamiya and Dr. K. Mihama for valuable discussions and Mr. M. Nonoyama and Mr. M. Ueda for useful help.

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