Microscopic Observation of Metal Surfaces Sputtered by Argon Ions †

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It is well known that surfaces of metals are cleaned by ion bombardment. The microscopic observations of surfaces cleared by ion bombardment are carried out until now and the mechanism of proceeding bombardment is explained qualitatively.[1,2] However, there are only few studies of comparisons between clean surfaces obtained by various ion bombardment techniques. This note reports the optical and scanning electron microscopic observations of metal surfaces eroded by means of ion micro-analyzer (IMA) and Grimm's lamp.[3,4] Some characterisitcs of IMA are already refered in our previous papers.[5,6] In the bombardment using Grimm's lamp, the sample current density and the sputtering rate of metal sample are much larger than those in IMA.

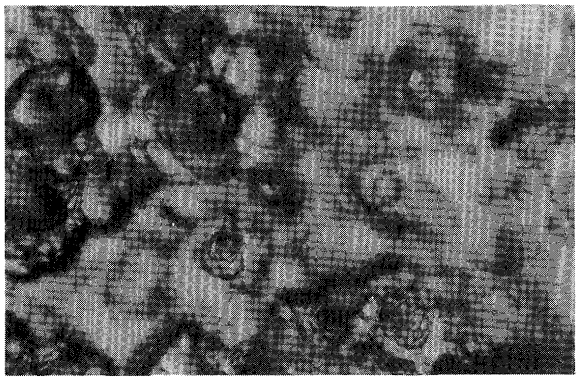
The experimental conditions are given in Table 1.

Table 1. Experimental conditions of IMA and Grimm's lamp

	IMA	Grimm's lamp
ion source	argon	argon
sputtered area	~1mmϕ	8mmϕ
accelerated voltage	10KV	600V
sample current	2μA	60mA
degree of vacuum	6×10^{-7}torr	—

Fe-3Cr-3Al alloys as experimental specimens were supplied to argon ion bombardment.

Figures 1 and 2 show optical and scanning electron micrographs of the surface bombarded using IMA, respectively. Optical microscopic observation shows considerable concave craters. On the other hand, scanning electron micrographs show that there are many conical protrusions.



100μ ×60

Fig. 1 Optical micrograph of the surface bombarded using IMA.

Figures 3 and 4 show optical and scanning electron micrographs of the surface bombarded using Grimm's lamp. Two kinds of patterns are observed in Fig. 3 which are like as ground digged with a shavel (right side) and wave fronts of waters (left side). They are due to orientation of different grains. Scanning micrographs are shown in Figs. 4(a) and (b) corresponding to right and left sides in Fig. 3 , respectively. They show almost same patterns and smooth surfaces. It will be anticipated that the features mainly depend on the sample current density and the sputtering time. Further experiments are now in progress to clarify the mechanism of ion bombardment.

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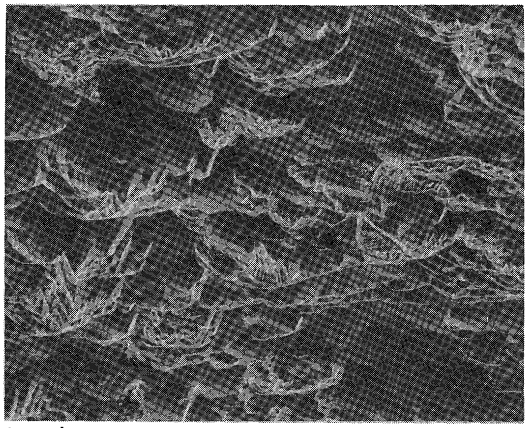
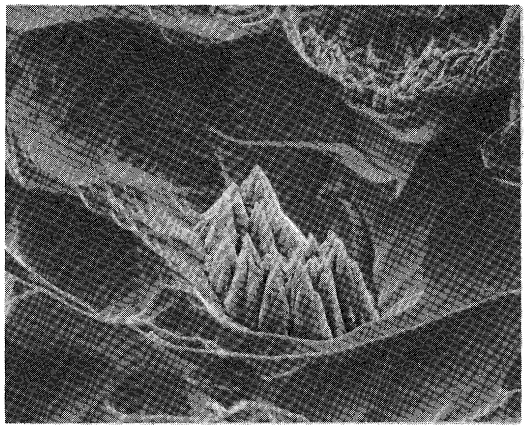


10μ ×700

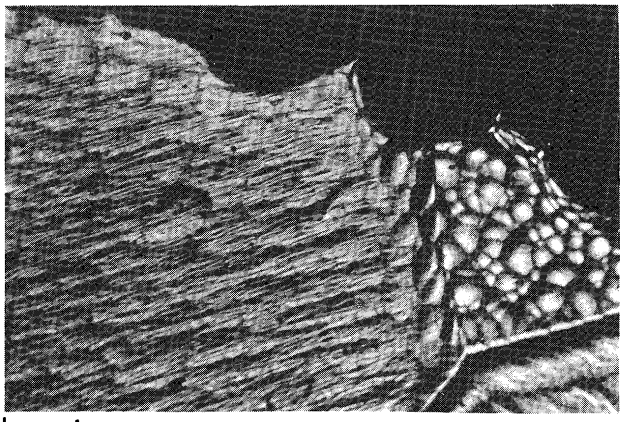
(a)



2μ ×3000

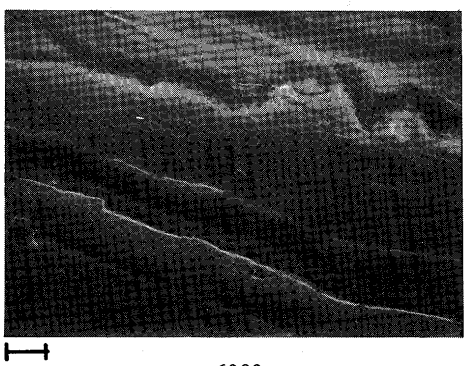
(b)

Fig. 2 Scanning electron micrograph of the surface bombarded using IMA.



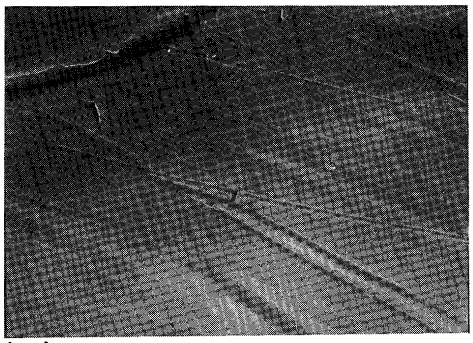
10μ ×400

Fig. 3 Optical micrograph of the surface bombarded using Grimm's lamp



(a)

1μ ×6000



(b)

1μ ×6000

Fig. 4 Scanning electron micrograph of the surface bombarded using Grimm's lamp.

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