SEM AND AFM CHARACTERIZATION OF SURFACE NANOFEATURES INDUCED BY 3.66 MeV-Al IONS IRRADIATION ON α-Al_2O_3.

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Solid surfaces are generally eroded when bombarded whith energetic particles, namely neutral atoms/molecules, ions, electrons, or photons. The phenomenon responsible for such erosion is knowN as sputtering and can produce morphological changes on materialS surface [Auciello-1984].

One of the more spectacular aspects of how ion beams modify the surface of solids concerns topographical changes. Examples include the break-up of flat surfaces into a system of geometrical facets [Hermanne-1970], the development of cliffs at grain boundaries [Auciello-1979, Auciello-1980], the evolution of ripples on obliquely bombarded surfaces [Carter-1977], the evolution of blunt asperities [Auciello-1980], and the development of cones and pyramids [Auciello-1979].

The mechanisms involved in cone or pyramid development is relevant not only as background to ion-solid interactions understanding, but also for production of bombardment-textured surfaces which are currently used in different technologies [Auciello-1981].

Bulk irradiation damage in alpha-alumina has been reported [Kinoshita-1994, Mchargue-1990, Youngman-1991], but not yet surface irradiation modification, which in turn could results affecting intrinsic as well as extrinsic physical properties like electric and catalytic ones.

In this work, using a high flux Tanden accelerator, Al ions with an energy of 3.66 MeV, were implanted on α-Al2O3 samples at 1000 °C. The experimental temperature was maintained constant between 10 °C as indicated through out by a pyrometer focused (1 mm in diameter) in the middle of the irradiated area (6 mm in diameter). All experiments were carry out under 10-7 mbar.

SEM observation evidences that surface nanofeatures like pyramids were induced by such irradiation (Fig. 1). These nanopyramids have around 50 nm basis with similar high and were detected at grains forming sometimes periodicall chains. The sharp faceting pyramids and its periodical arrays, induce to think that a crystallographic preferential sputtering taked place during the irradiation.

References

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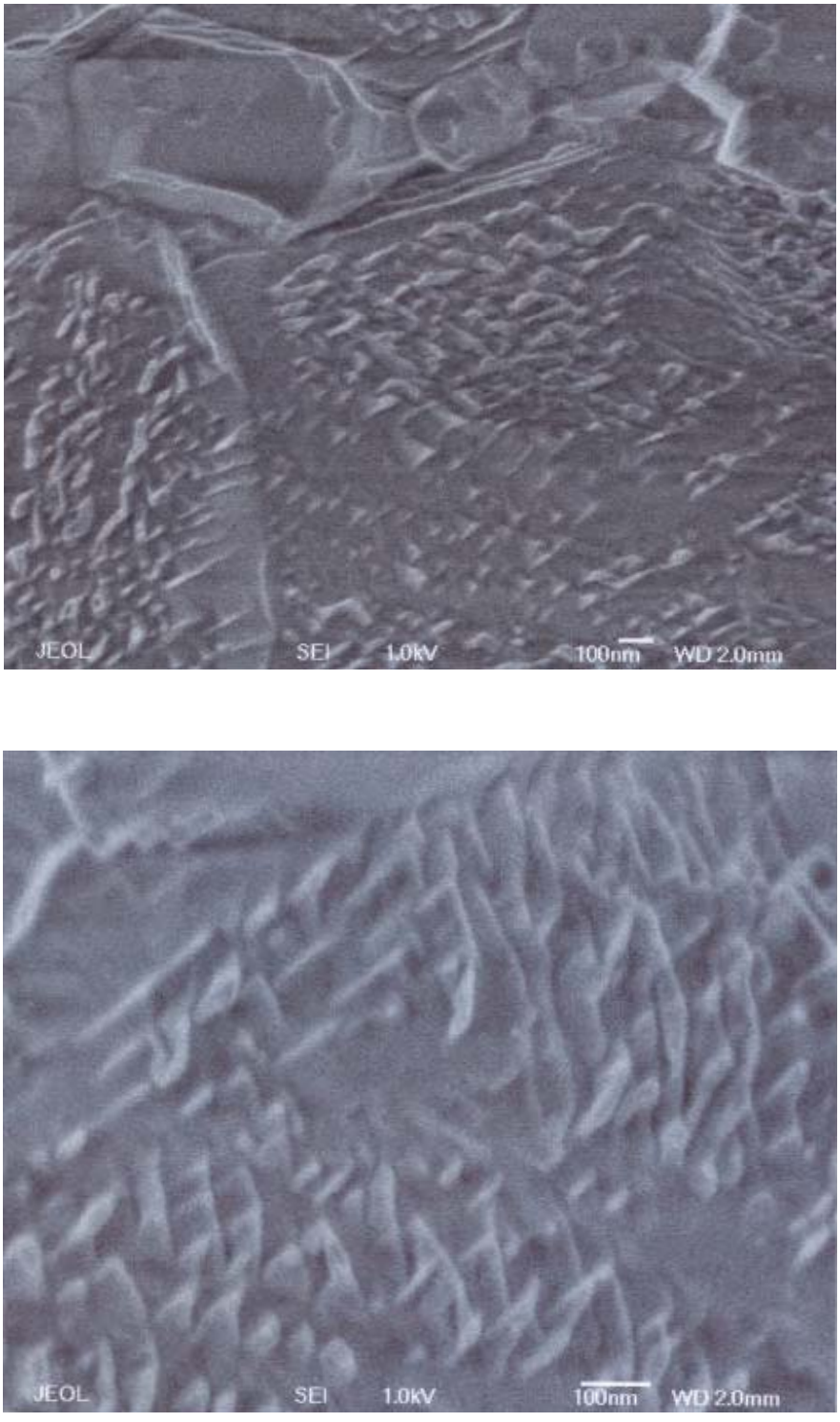

Fig. 1 High resolution micrograph by SEM. Irradiated area (250 dpa).