Poster

ION BEAMS IRRADIATION EFFECT ON NANOHARDESS OF SILICON

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Abstract

Nanohardness is defined as a materials resistance to permanent or plastic deformation at the nano-micro scale. Nanohardness is a significant mechanical properties of materials used to characterize the wear resistance of materials mailny. Most mechanical parts like bearings, gears, and shafts are produced by finishing processes such as hard turning, grinding and/or honing. The durability and reliability of these precision products are directly influenced by mechanical behavior specially nanohardness. This paper describes how ion beam irradiation influence the nanohardness property of materials i.e. effects on nanohardness of silicon.

If mechanical parts are in micro nano scale such as micro interconnector, micro valve, micro actuator, micro switch in those case nanohardness is an important factor for better performance. In the present paper discusses ion beams irradiation effects on hardness in micronano scale is discussed.

The experiment was completed by a 10- GHz NANOGAN ECR ion source installed at Kochi University of Technology (KUT), Japan. Ar^{+4} ions with energy 60 keV, 100 keV, 200 keV and 400 keV were irradiated on Si through a Cu stencil mask at room temperature. The dimension of the used mask thickness was 10 µm with square hole size 43µm x 43 µm. For the three different energies, the dose on sample was 500 qµC/cm^2 constant where q denotes the charge states of the irradiated Ar ions. After ion beam irradiation the nano indentation was done by Nano Indenter-II at Harbin Institute of Technology (HIT) ,China.

Nanohardness for 60 keV, 100 keV, 200 keV and 400 keV were measured to be 10.807 GPa, 10.187GPa, 10.029 GPa and 9.84 GPa respectively. Finally the effect of ion beams irradiation on nanohardness of silica is compared graphically for different accelerating energy. It shows hardness property depends on accelerating energy

Figure 1 shows the relation between accelerating energy and nanohardness on irradiated surface. The relation shows nanohardness decreases with the increases of accelerating energy. It also noted that it decreases very sharply between 60keV and 100 keV accelerating energy. After 100 keV the hardness decreases smoothly.

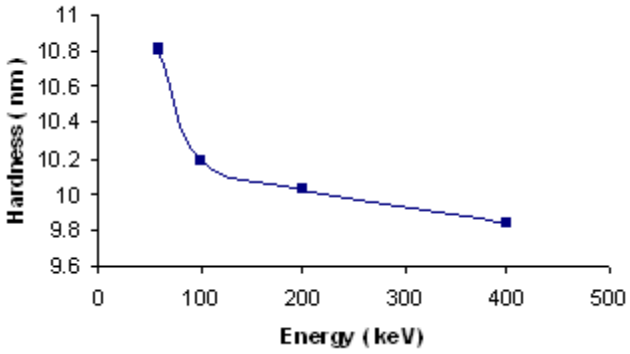

Figure 1 Energy vs. Hardness of irradiated Si.

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Nanotechnology is an outgrowth and extension of microfabrication. Newly developments in mechatronics and robotics expand their application fields. Superior functions with advanced control are required in mechatronics system and robotic system. In those systems nanohardess of materials are important factor for better performance in micro nano scale. The current paper gives the idea how nanohardness property changes with different acceleration energy during micro nano scale fabrication by ECR ion beam irradiation. It seems this technique will helpful to improve mechanical properties during micro nano fabrication.

References:

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