3 keV ION BOMBARDMENT GUN WITH POWER SUPPLY

ION BOMBARDMENT GUN
MODEL 981-2043

Rapid, precise depth profiling of film structures on surfaces is now possible with the Varian Ion Bombardment Gun. The Ion Bombardment Gun provides a high current density ion beam for sputter cleaning sample surfaces for LEED and Auger surface analysis work. The beam energy is variable from 0 to 3000 electron volts with current densities (for argon ions) exceeding 300 $\mu A/cm^2$ at a gun-sample distance of 5 cm at the highest energy. An electrostatic lens system provides beam focusing, and deflection plates allow beam positioning as well as high frequency scanning in both the X and Y axis. Removal rates with the new gun can be controllably varied over orders of magnitude by varying the ion energy from 300 eV to 3 keV; by varying the beam current density from 0 to over 300 $\mu A/cm^2$; and by scanning the beam, which reduces the average current density at any particular point.

SCANNING

Scanning is an important feature of the Varian ion bombardment gun. When used in depth profile studies, scanning provides uniform removal rates that produce a wide, flat-bottomed crater to remove the undesirable characteristics of crater walls from the point of the analysis.

Secondly, for various types of analyses, scanning is useful for uniformly sputtering a large area (1 cm^2 at 5 cm from the gun) of the sample. Finally, it permits an accurate and reproducible method for setting the average ion beam current density. This is accomplished by monitoring the current density as the beam is scanned over the Varian Beam Probe, described below.

DC DEFLECTION

The deflection plates are also very useful for static beam alignment. When scanning is not required, the dc deflection capability of the ion gun allows precise placement of the ion beam, ensuring that the ion gun beam and electron gun beam are centered on the same spot.

OTHER ADVANTAGES

Electrostatic focusing of the ion beam provides a spot size at the sample of approximately 3.5mm (FWHM) at a distance 5 cm from the gun with an ion beam energy of 300 eV.

In the event of a filament burnout in the middle of a vacuum cycle, the switchable dual filament assembly permits continued operation without interrupting the work in progress. At the end of the cycle, filament replacement is simplified by a plug-in anode-extractor assembly.

The new tapered head design allows greater accessibility for mounting the ion gun and other instruments close to the sample and CMA head. The gun is mounted in a port with 2¾ inch ConFlat® Flange and 1.5 inch ID tubulation (1.75 inch O.D.). The gun is fully bakeable to 250 °C.

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The ion gun power supply provides a continuously variable acceleration voltage of 0-3000 volts. Beam current stability is assured by feedback regulation of the emission current which is variable from 0-40 mA.

Beam focus is controlled by an adjustable voltage applied to the electrostatic lens in the gun. X- and Y-axis deflection controls allow precise dc positioning of the ion beam over a ± 5mm range. In addition, two high frequency area scans may be used to permit rapid change of the average current density.

The unit has an automatic degas feature for cleaning the gun after exposure to atmosphere and before an ion bombardment operation. The power supply automatically sets the proper current and voltage levels, then turns them off automatically after a preset time.

A termination is provided for connection to a remote beam energy on/off switch which would allow, for example, externally timed depth profile measurements.

Operating Principle

The ion gun has an electron impact ionization source and an electrostatic lens system for accelerating, focusing, and deflecting the ion beam. A schematic diagram of the ion gun is shown in Figure 2. The electrons emitted from the filament are accelerated into the cylindrical grid cage by a positive potential. Electron impact on the inert gas atoms within the grid cage produces ions that are accelerated towards the three-element lens by the extractor, then out of the gun assembly where they impinge on a sample surface.

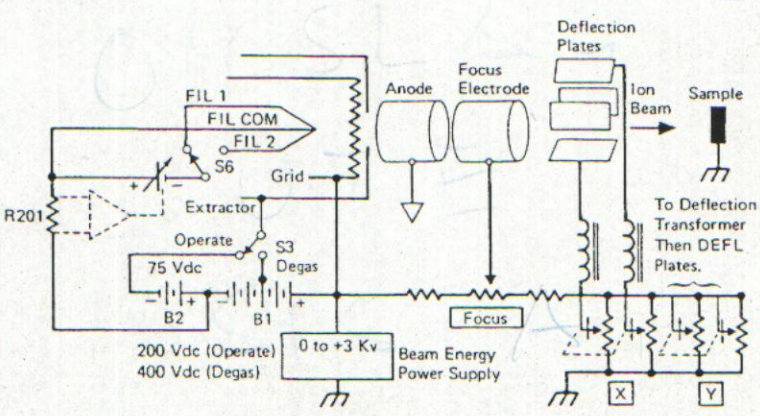

Figure 2. Ion bombardment gun, schematic diagram