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イオンビーム引出領域部でカーボン微粒子挙動
Behavior of carbon dust in an extraction line

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Ⅰ．Outline

Particle emission in semiconductor manufacturing system, and the successive particle transport to the surface of produced wafers deteriorate the production through put, and decrease reliability of the system. For example, ion implanter for implanting an impurity dopant into semiconductor materials has been subject to protection against dust emission, particle emission and transport are possible from ion source and extraction electrodes.

Thus, a system that detects particle emission and monitors the dust transport come to be indispensable for semiconductor process devices.

Ⅱ.Experiment device

Fig.1 shows a schematic diagram of the experiment device. The components are installed in a vacuum chamber with a test ion source with a single extraction hole. The sample source is a cold cathode monoplasmatron ion source made of carbon materials including carbon made extraction electrodes. The plasma is generated in an ion source 35.6 mm inner diameter and 40.0 mm long. The extraction electrode structure has 2.0 mm hole diameter and 2 mm ion acceleration gap. The vacuum chamber is 165 mm inner diameter, and 120 mm long. The ion source and the laser to illuminate dust particles are installed at the bottom of vacuum chamber.

Fig.2 shows a schematic diagram of the dust detection system. The test detection system consists of a laser at 532 nm wavelength, a mirror to guide the beam to traverse the ion beam perpendicularly, a cylindrical lens to make a sheet-shaped laser beam, a laser slit to a laser damp to prevent the reflection of a sheet-shaped laser beam, narrow band (3 nm or 10 nm) interference filter, and a web camera. The size of the sheet-shaped laser beam entrance slit is 20 mm wide, and 5 mm high. The laser dump entrance size of the sheet-shaped laser beam is 38 mm in width, 5 mm in height.

Ⅲ.Result and discussion

The experiment has been conducted with; condition [0.1 Pa] Argon gas pressure, [700 V] extraction potential, [300 V] discharge voltage, [0.01 A] discharge current, and, [188 μm] carbon powder preloaded at simulation dust particle. Input particles are imaged with the web camera when laser beam is irradiated onto a beam line. Image of the dust cloud had been monitored successful, but the present laser dump system is insufficient for diminishing reflector. The detection system will be capable of analyzing particle motion to determiner value of velocity based upon signals of photodiode coupled to a narrow band interference filter of different wavelength.

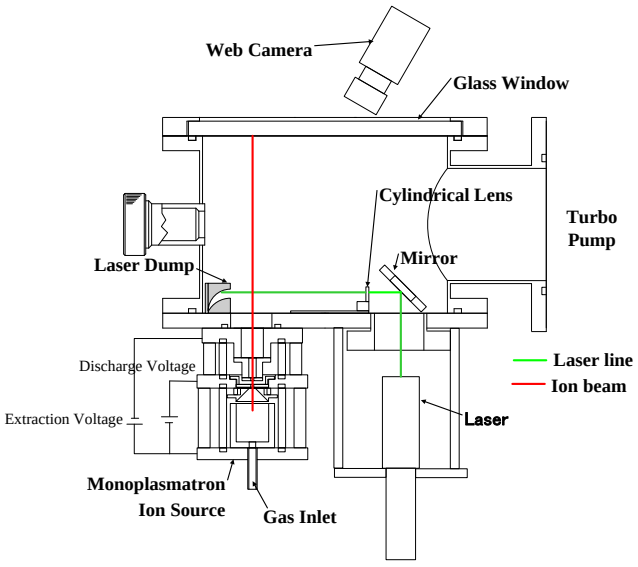

Fig.1 Schematic diagram of the experiment device

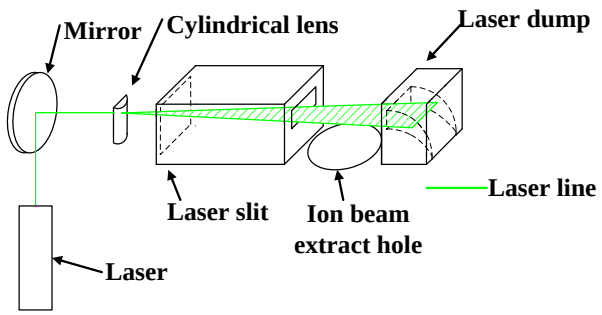

Fig.2 Schematic diagram of the dust detection system