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Dust Particle Diffusion in Ion Beam Transport Region

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Ion beam equipment produces dust particles of μm order sizes in an ion beam transport region. The particles originate in ion source plasma, and traverse the extractor to reach the region of low density ion beam produced plasma. The transport of dust particles is determined by local electric fields formed at the boundary of the ion beam produced plasma. An experimental setup is assembled to measure the distribution of dust particles in the ion beam transport region. The setup consists of a test chamber, a monoplasmatron source, an extractor and a solid state laser. A monoplasmatron plasma generator has a hollow cathode electrode, an anode electrode and a floating electrode that constricts plasma flow from the cathode to the anode. A 100 mm outer diameter 70 mm height Pyrex glass tube houses the monoplasmatron electrodes. Three electrodes with their 2 mm diameter apertures at the center served as the extractor to form the ion beam. All monoplasmatron electrodes are made of graphite and the produced carbon dusts by plasma sputtering are extracted to the ion beam transport region in the test chamber having 310 mm inner diameter and 120 mm height cylindrical shape. A graphite laser dump which has a triangular prism shape is held in the test chamber to eliminate a reflection laser light. Laser scattering light from an incident laser light at 532 nm wavelength shows where and when a μm order particles passes through the ion beam transport region. As the result, dusts with the size more than 10 μm were found distributed in the center of the ion beam, while less than 10 μm size dusts distributed along the edge of the ion beam. This observation coincides with the charge up model of the dust in the plasma boundary region.