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Plasma characterization and technological application of a heater less hollow cathode plasma source with C-shape scanning device

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An efficient large volume plasma source with large substrate area coverage has been established by arranging a multi-pole line Cusp Magnetic Field (MMF) and two C-Shape scanning devices in front of a heatless hot hollow cathode electron emission source, allowing for higher ionization efficiency and large area surface treatment for industry use. Substrate collected ion current topographic plot shows both higher solenoid coil generated axial magnetic field and reduction of feed gas flow (Argon) could effectively increase plasma source ionization efficiency. Diamond-like coating (DLC) deposition method has been used to access the C-shape scanning device effectiveness for large area coverage with good uniformity. Generally, with solenoid coil generated magnetic field and MMF, a strongly increased ability for the reactive process dissociation and ionization was observed. The effectiveness of scanning device has been approved by the deposited DLC film color as well as thickness distribution measurement, the effective coverage can be up to 600mm with less than 10% uniformity.

Two applications related to the coating applied onto the tools and components are discussed: the anti-static discharge coating on the wafer contact surface of tools and components used in semiconductor industry to provide protective properties against Electrostatic Discharge (ESD) and DLC coating for 2D material encapsulation. The first mentioned ASD coating could be an excellent solution to raise production yield due to their provision of ESD protection and their good tribological properties. The second coating acts like a Permeation Barrier or Moisture Barrier against gases (e.g. oxygen) and moisture for 2D material such as Perovskite coating for Solar application.

Primary author: SHENGFU, Zhao (Nanyang university SINGAPORE)

Presenter: SHENGFU, Zhao (Nanyang university SINGAPORE)

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