Contribution ID: **127** Type: **Invited Oral**

Beam extraction and transport for high current ribbon-beam ion implanters

Monday, 8 September 2025 11:10 (30 minutes)

High current ion implanters for semiconductor manufacturing are primarily used for doping and amorphization of source and drain regions of devices on silicon wafers. Most often this is done with a spot beam that is scanned across the wafer as the wafer moves up and down. Applied Materials does it with a ribbon beam that allows for greater dose rate on the wafer. With this architecture comes the added hurdle of meeting customer requirements of high dose uniformity across a 300 mm wafer.
This requires extracting tens of milliamps from a 4 cm2 slit and implanting the wafer with a parallel ribbon beam that is uniform in current across the wafer to better than 1%. The shape of the extracted and transported beam is associated with the meniscus at the plasma boundary. Tuning the shape is done with adjustments to the plasma conditions and extraction settings. We discuss some of the challenges and achievements with meeting these requirements.
The magnetized ion source can create fluctuations in the extracted beam current and affect the transmission of the beam through the implanter beamline. Plasma rotations in the ion source caused by an ExB force, affects the extracted beam current amplitude, resulting in an ion beam that pulsates with a frequency in the range of 100 kHz. The creation and transmission of this cyclic behavior is discussed.
Finally, we discuss the concept of a digital twin for ion implanters. Customer requirements for the beam characteristics at the wafer necessitate the tuning of multiple optical components along the beamline. Integrating all these components in a digital twin model enhances the user experience in understanding the multiple steps of an ion implanter.

Primary author: Dr PEREL, Alexander (Applied Materials, Inc.)

Presenter: Dr PEREL, Alexander (Applied Materials, Inc.)

Session Classification: Oral Session

Track Classification: Applications of ion sources