ION IMPLANTATION TECHNOLOGY FOR PRECISION MATERIALS MODIFICATION: RECENT PROGRESS IN BEAMLINE AND PLASMA DEVICES

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Abstract

Ion implantation technique is essential to modern integrated-circuit (IC) fabrication and precision materials modification (PMM). Doping or otherwise modifying semiconductor materials involves generating an ion beam and steering it into the substrate so that the ions come to rest beneath the surface. At low implant energies (<5 keV), traditional beamline technologies suffer from low beam transport efficiency due to space charge related difficulties. New beamline implanters, running in deceleration mode, can achieve high beam currents, but are still limited by space charge expansion at ultra low energies and by charge exchange collisions between ions and residual neutrals. Consequently plasma based implantation technologies were developed to enable high dose implants (>5x10^{15}/cm^2) at low energy (0.02< ε <10 keV). The AMAT/Varian PLAsma Doping system (PLAD), has been developed with a unique architecture suited for precise and repeatable dopant placement for PMM. Critical elements include a pulsed DC wafer bias, modulated rf power, closed-loop dosimetry and a uniform low energy, high density plasma source. In this talk key performance parameters such as dose uniformity, dose repeatability, dopant angle and profile control will be presented. The complex plasma chemistry, electron and ion transport in these systems will be discussed. Calculations of rate coefficients for radical ion production in BF_3 will be presented. Beamline implanters and plasma doping devices will be compared.

About the Speaker: **S. Radovanov received the B.S. and M.S./Ph.D. from the Univ. of Belgrade after which she was a researcher at International Atomic Energy Agency (IAEA) in Vienna. She then continued her postdoctoral studies at National Institute of Standards and Technology (NIST), Gaseous Electronics Laboratory in Gaithersburg Maryland and at the University of New Mexico. Plasma Laboratory. For the past 15 years she has been with the AMAT/Varian Semiconductor research and development laboratory.**