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Plasma expansion dynamics physics: An understanding on ion energy reduction process DAVID RUZIC, SHAILENDRA SRIVASTAVA, KEITH THOMPSON, JOSHUA SPENCER, JOHN SPORRE, University of Illinois at Urbana-Champaign, UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN TEAM — This paper studies the expanding plasma dynamics of ions produced from a 5J Z-pinch xenon light source used for EUV lithography. Ion energy reduction is essential for the successful implementation of this technology. To aid this investigation, ion energy from a z-pinch DPP plasma source is measured using an ion energy analyzer and effect of introducing a small percentage of low Z material on the ion energy and flux is investigated. Presence of low mass such as H_2 or N_2, shows a considerable reduction in total flux and in average energy. For example, Xe^+ ion flux at 5 keV are recorded as 425 $\pm$ 42 ions/cm^2.eV.pulse at 157 cm and reduced to 125 $\pm$ 12 ions/cm^2.eV.pulse when using the low mass into the system at same energy. It is also noticed that such a combination leads to decrease in sputtering without changing the EUV output. Study of the possible mechanism supporting the experimental results is numerically calculated. This computational work indicates that the observed high energies of ions are probably resulting from coulomb explosion initiated by pinch instability. It is postulated that the electrons leave first setting up an electrostatic potential which accelerates the ions. The addition of small mass actually screens the potential and decorates the ions.

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