Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Structure and expansion characteristics of laser ablation tin plasma into a vacuum QIUSHI ZHU, JUNZABURO YAMADA, NOZOMU KISHI, TOMONAO HOSOKAI, MASATO WATANABE, AKITOSHI OKINO, KAZUHIKO HORIOKA, EIKI HOTTA, Tokyo Insitute of Technology — The structure and expansion characteristics of the plasma plume produced by laser ablation of a bulk tin target in vacuum have been investigated. A Q-switched Nd: YAG laser with 1064 nm wavelength, 5 ns pulse width, and the order of 10^{11} W/cm^2 power density was employed to create ablation plasma. Time-of-flight (TOF) measurements using a movable Faraday cup were conducted to study the velocity distributions of the tin ions in the ablation plume. The results exhibited triple-peak structure of the TOF spectra: two groups of fast ions with the mean velocity of $\sim$100 km/s and $\sim$60 km/s respectively, and a dominating slow ion group with the velocity less than 50 km/s. By fitting the velocity spectrum of the slow ion group with shifted-Maxwell-Boltzmann distribution, a multimodal structure with three distinct velocity distributions attributed to the ions with different charge states was obtained. The evolution dynamics of the Sn I and Sn II in the erosion tin plasma plume were compared using the optical emission lines. The results displayed different plume shapes of Sn I and Sn II due to different contributing factors towards the expansion dynamics; the drift velocity of Sn II in the plasma plume was in good agreement with the TOF results of the Faraday cup experiment.

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Date submitted: 11 Jun 2009 Electronic form version 1.4