Study of tin-droplet target EUV source

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INTRODUCTION

A tin-droplet target will be able to supply the minimum mass to generate the EUV plasma, leading to substantial debris mitigation. First, basic EUV plasma experiment was performed on a single shot base using a tin- sphere suspended with a glass stalk. This scheme enabled us to control irradiation precisely. Integrated experiment is just started using successively supplied tin-droplets and 5-100 kHz, 5kw laser system.

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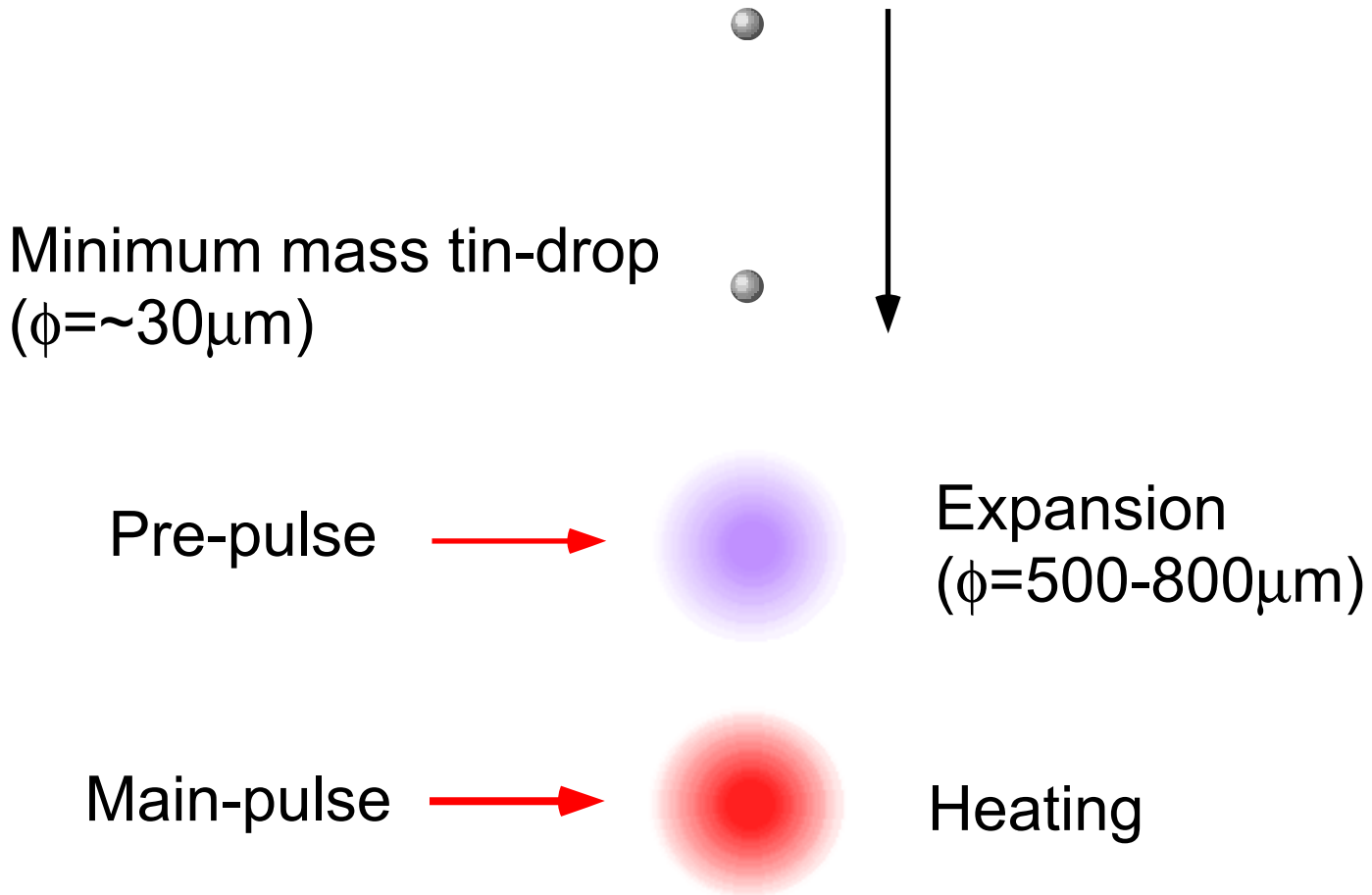
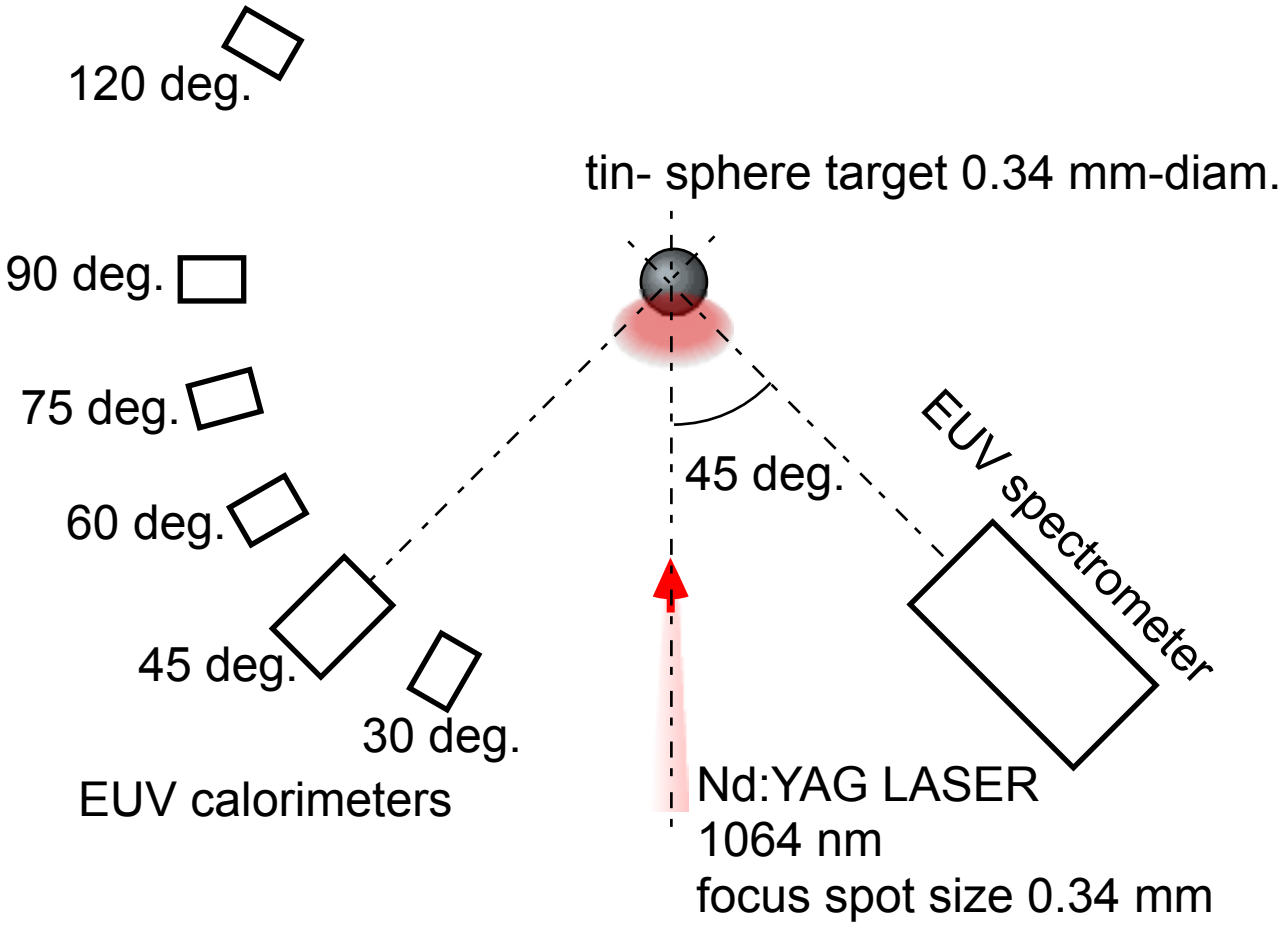
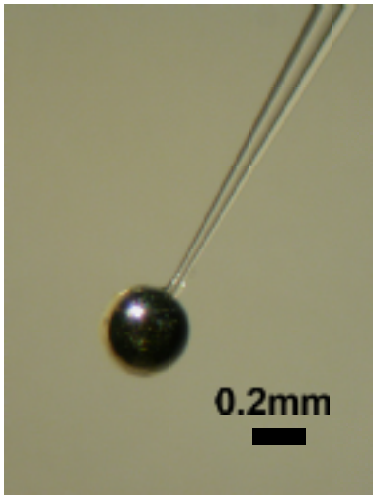


Experimental arrangement

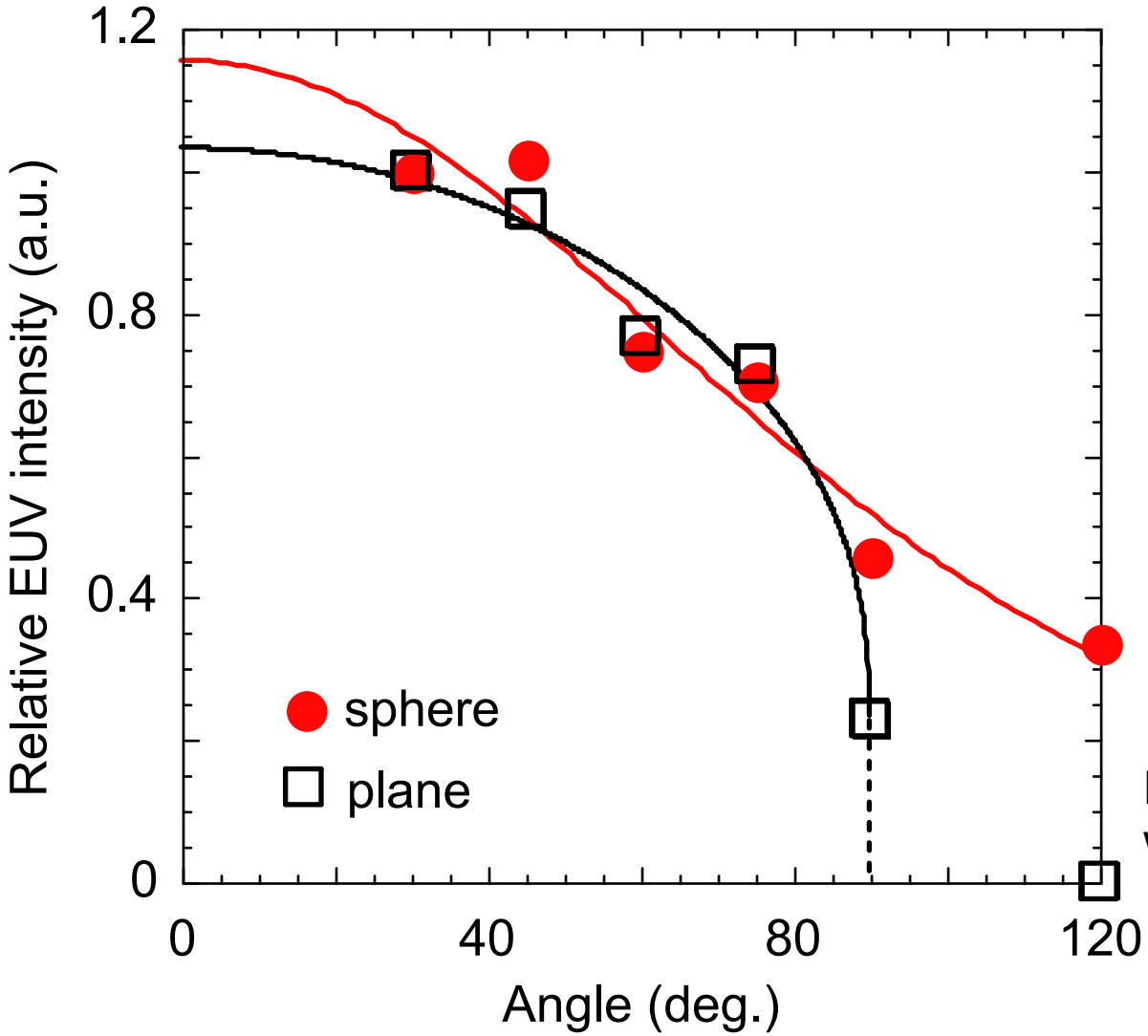




Enlarged photograph of a tin-sphere target

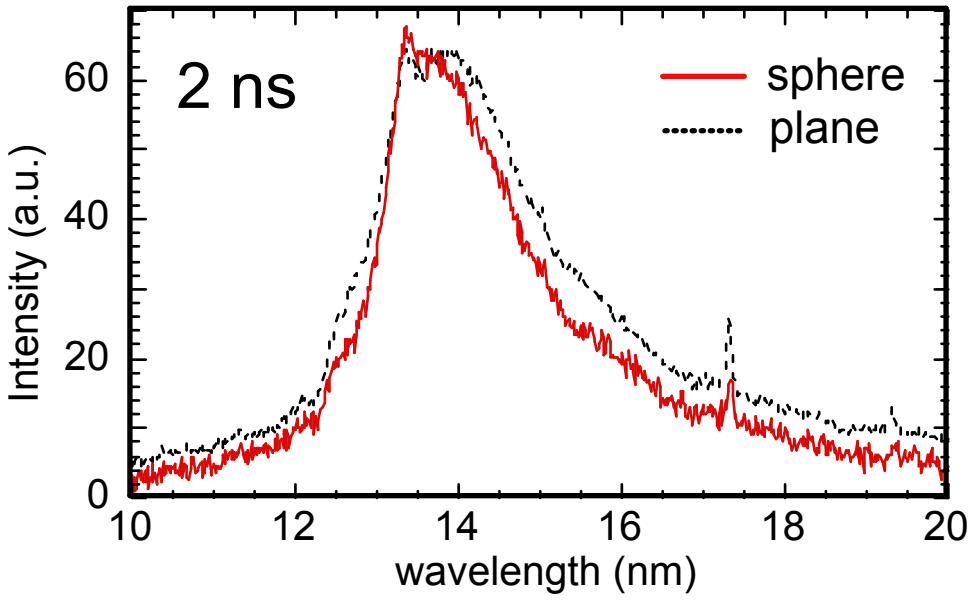
Intensities of the laser : $1 \times 10^{10} - 4 \times 10^{11}$ W/cm^2 (2ns pulse)
$1 \times 10^{10} - 2 \times 10^{11}$ W/cm^2 (8ns pulse)

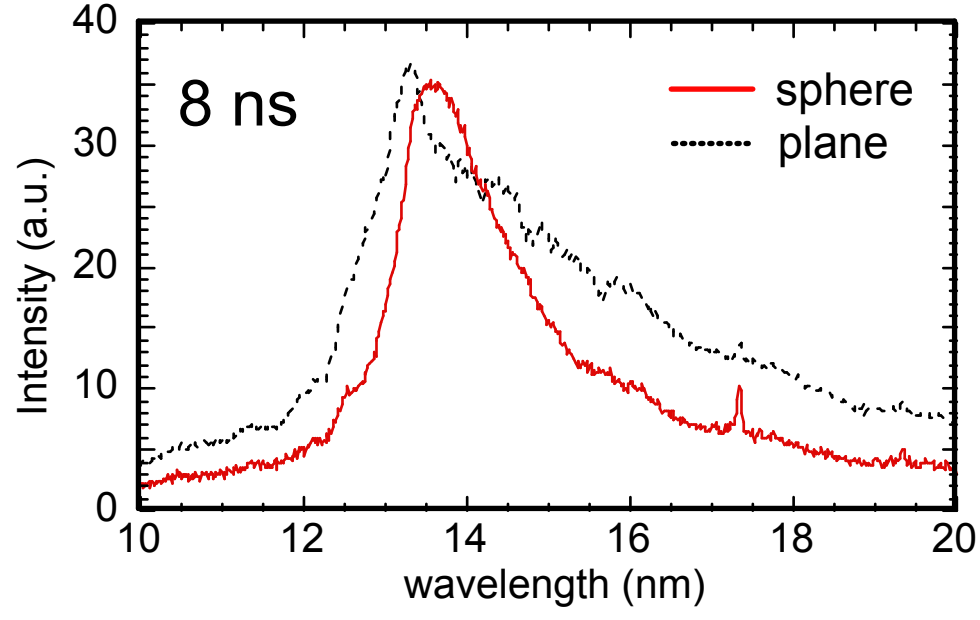
The distribution for the tin-sphere target is uniform compared with the case for the plane-tin target



EUV profile of the plane-tin was fitted by cosine function.

A spectrum dip at around 13.5 nm is not shown for the tin-sphere target

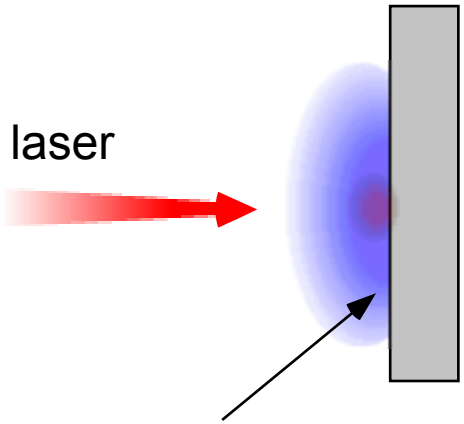




The spectrum dip is more obvious for the 8 ns case

Low temperature plasma generated in a peripheral region due to thermal conduction may enhance the self-absorption feature

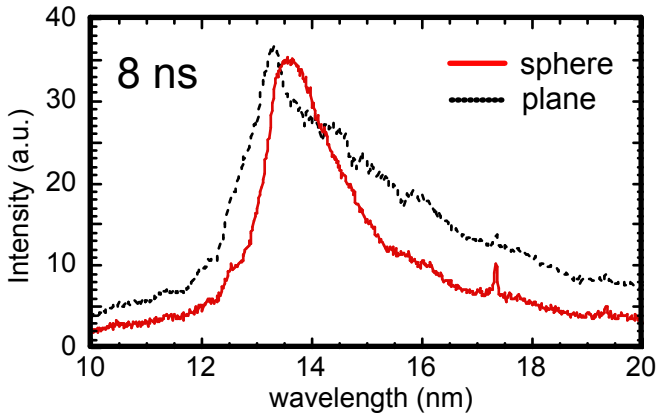
plane



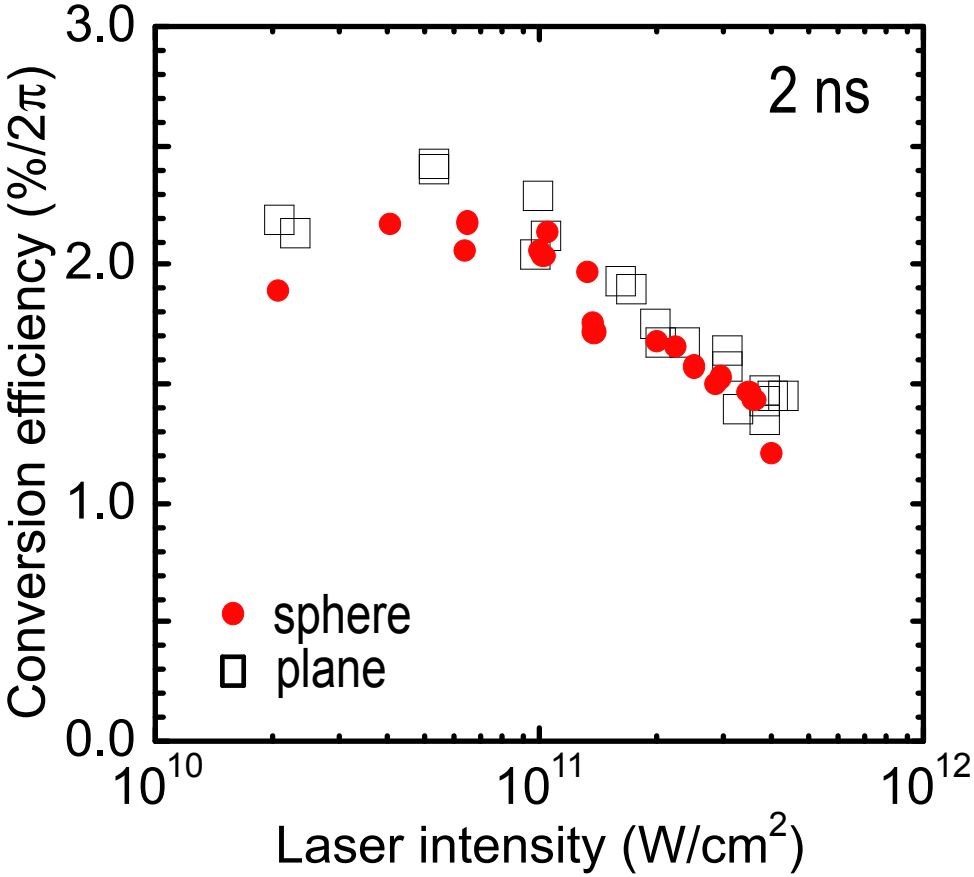
Low temperature plasma generated in a peripheral region

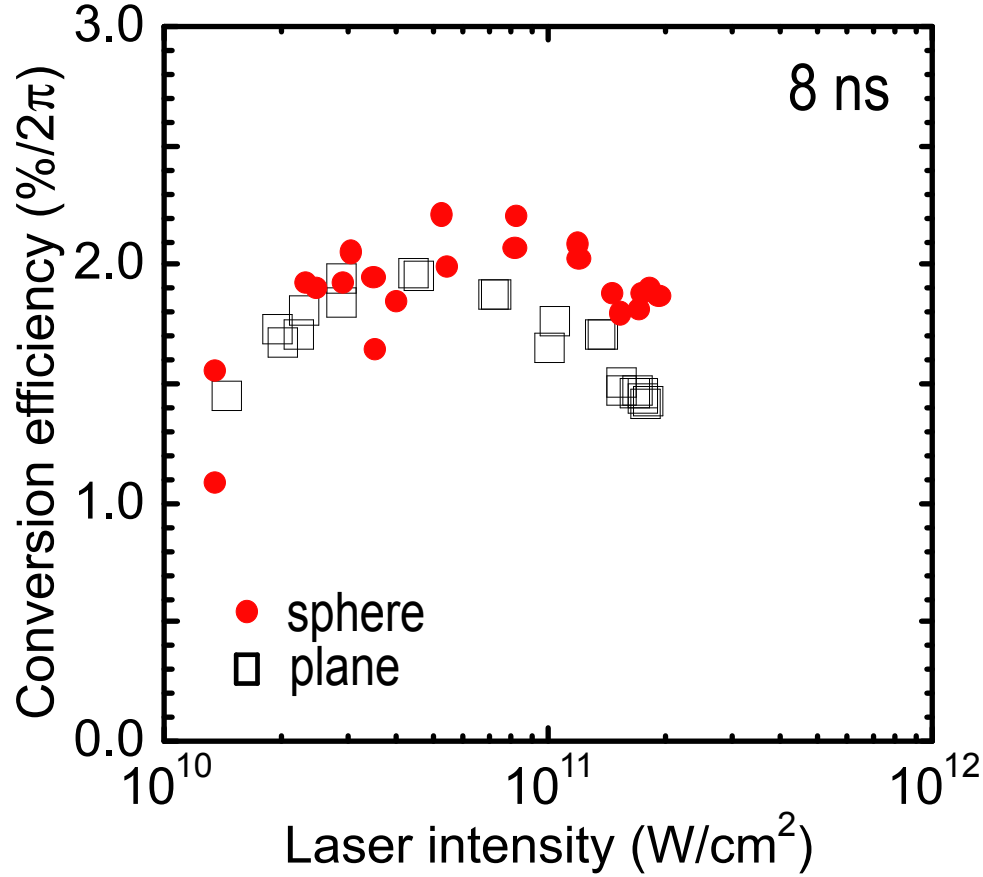
sphere

The laser spot and diameter of the sphere were almost the same, so that, even if low temperature plasma is generated, it does not make notable influence on the absorbed spectra



The conversion efficiency for the tin-sphere target at 8 ns pulse irradiation case is higher than the planer target because of the low EUV absorption

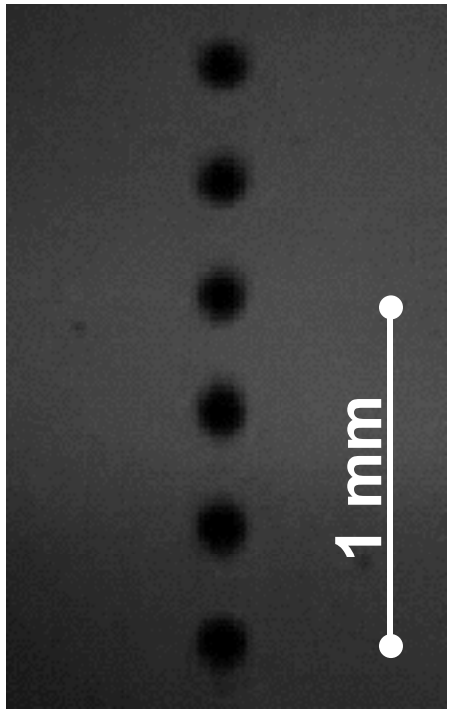


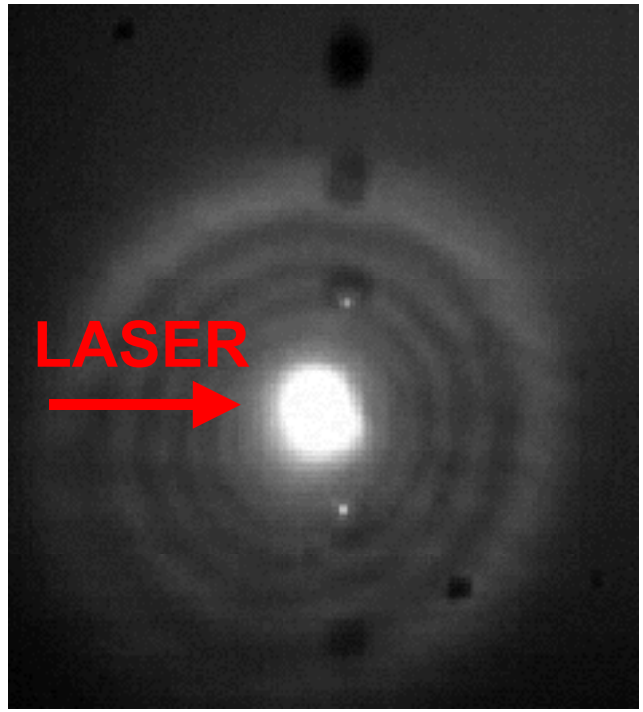


The conversion efficiency for the tin-sphere target was calculated within 2π solid angle emission

Tin-droplet generator is developed by University of Hyogo

A tin-droplet generator





Droplet 0.2 mm-diam.
20 kHz
9 m/s

SUMMARY

- Basic EUV plasma experiment was performed on a single shot base using a tin- sphere suspended with a glass stalk
- A spectrum dip at around 13.5 nm is not shown for the tin-sphere target
- The conversion efficiency for the tin-sphere target at 8 ns pulse irradiation case is higher than the planer target because of the low EUV absorption
- Integrated experiment is just started using successively supplied tin-droplets and 5-100 kHz, 5kw laser system

This work was performed under the auspices of Leading Project promoted by MEXT Japan.This work was performed under the auspices of Leading Project promoted by MEXT Japan.