

Investigation of ion energy distribution functions in EUV-induced plasmas by ion mass spectrometry

Citation for published version (APA):

van de Ven, T. H. M., Reefman, P., Osorio, E. A., Banine, V. Y., & Beckers, J. (2016). *Investigation of ion energy distribution functions in EUV-induced plasmas by ion mass spectrometry*. Abstract from 43th IEEE International Conference on Plasma Science, ICOPS 2016, Banff, Alberta, Canada.

Document status and date:

Published: 22/06/2016

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

INVESTIGATION OF ION ENERGY DISTRIBUTION FUNCTIONS IN EUV-INDUCED PLASMAS BY ION MASS SPECTROMETRY

Tijn H.M. van de Ven¹, Pim Reefman¹, Edgar A. Osorio²,
Vadim Y. Banine^{1,2} and Job Beckers¹

¹ *Eindhoven University of Technology, P.O. Box 513,
5600 MB Eindhoven, The Netherlands*

² *ASML, De Run 6501, 5504DR Veldhoven, The Netherlands*

The creation of plasma by direct photo ionization by extreme ultraviolet radiation (EUV, 13.5 nm) is a common phenomenon in extraterrestrial planetary nebulae. However, this process has been difficult to reproduce in a laboratory because of the scarceness of EUV radiation sources. With the development of next-generation lithography tools, using EUV radiation to create smaller features on computer chips, EUV induced plasmas are now created in the low pressure background gas in lithography tools. Industries have realized that these plasmas are of significant importance with respect to machine lifetime.

EUV induced plasmas affect exposed surfaces due to impacting ions. In this research an ion mass spectrometer, capable of measuring mass resolved energy spectra, is used to investigate the ion fluxes and ion energy distribution functions (IEDF) of EUV-induced plasmas. A xenon pinch discharge produces EUV radiation, which is focused into a measuring vessel with a low pressure hydrogen environment. In this vessel photo ionization creates free electrons with energies up to 76 eV, which further ionize the background gas by electron impact ionization.

Ions are sampled through a 50 μm orifice in the spectrometer's front plate. The influence of pressure and EUV power on the IEDF of the EUV-induced plasma are investigated. The results show the fast transformation of H_2^+ to H_3^+ by collisions with the background gas as a decrease in $\text{H}_2^+ / \text{H}_3^+$ -ratio with pressure and distance to the EUV beam.