Absolute calibration of an energy resolved ion mass spectrometer and Retarding Field Energy Analyzer

Citation for published version (APA):

Document status and date:
Published: 04/12/2015

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.

Download date: 29. Nov. 2019
One of the most useful quantities in a plasma is the ion energy distributions (IEDF), which determines processes as etching and deposition. In this research an EUV-induced plasma is investigated to determine the influence on the lifetime of components in the next-gen lithography tools (see poster 33 Pim Reefman).

**Setup**

The EQP, RFEA and a Faraday cup are aligned to the same position in the middle of the vessel. The ion gun and a remote RF plasma unit are positioned opposing the EQP.

**Absolute Calibration**

The measured ion flux has to be transformed to an absolute flux density. The transmission factor \( \kappa(E, m_{ion}) \) has to be determined:

\[
\Gamma = \kappa \times \frac{\text{Measured ion flux}}{A} \quad \text{s}^{-1} \text{m}^{-2} \text{V}^{-1}
\]

To determine the total ion flux densities from Faraday cup, RFEA and EQP are compared:

- **Faraday cup procedure:**
  1. Measure total flux current density

- **RFEA procedure**
  1. Measure IEDF
  2. Integrate IEDF to obtain RFEA total flux current

- **EQP procedure**
  1. Measure IEDF for all m/z
  2. Add IEDFs of all m/z to obtain the total IEDF
  3. Integrate IEDF to obtain EQP total ion current

**Flaw of procedure**

Because the Faraday cup and RFEA cannot distinguish between ionic species it is not possible to determine mass dependent transmission functions.

**References**


**Acknowledgements**

Many thanks to Rogier van den Bos from the University of Twente for allowing me to use his ion gun setup.

---

**SETUP**

The EQP, RFEA and a Faraday cup are aligned to the same position in the middle of the vessel. The ion gun and a remote RF plasma unit are positioned opposing the EQP.

**CHROMATIC ABERRATIONS**

Ions are transported through the EQP using electrostatic lenses. As with refractive optics, chromatic aberrations can occur which distort the measured IEDF.

**Procedure**

The focal points of the 1st lens system and Lens 2 should coincide for all ion energies.

1. Set \( V_{\text{Lens 1}} \) and \( V_{\text{Extractor}} \)
2. Find optimum \( V_{\text{Lens 2}} \) for all energies
3. Calculate standard deviation in \( V_{\text{Lens 2}} \)
4. Repeat with different \( V_{\text{Lens 1}} \) and \( V_{\text{Extractor}} \)

**Hydrogen**

![Hydrogen Graph](image)

**Nitrogen**

![Nitrogen Graph](image)