

# Electrochemical Reduction of Iron Oxide - Produced from Iron Combustion - for the Valorization of Iron Fuel Cycle

**Citation for published version (APA):**

Majid, A. I., Tang, Y., Finotello, G., van der Schaaf, J., & Deen, N. G. (2022). *Electrochemical Reduction of Iron Oxide - Produced from Iron Combustion - for the Valorization of Iron Fuel Cycle*. Abstract from 242nd Electrochemical Society Meeting, Atlanta, Georgia, United States.

**Document status and date:**

Published: 13/10/2022

**Document Version:**

Author's version before peer-review

**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](http://www.tue.nl/taverne)

**Take down policy**

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

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.

Your abstract submission has been received

Click [here](#) to print this page now.

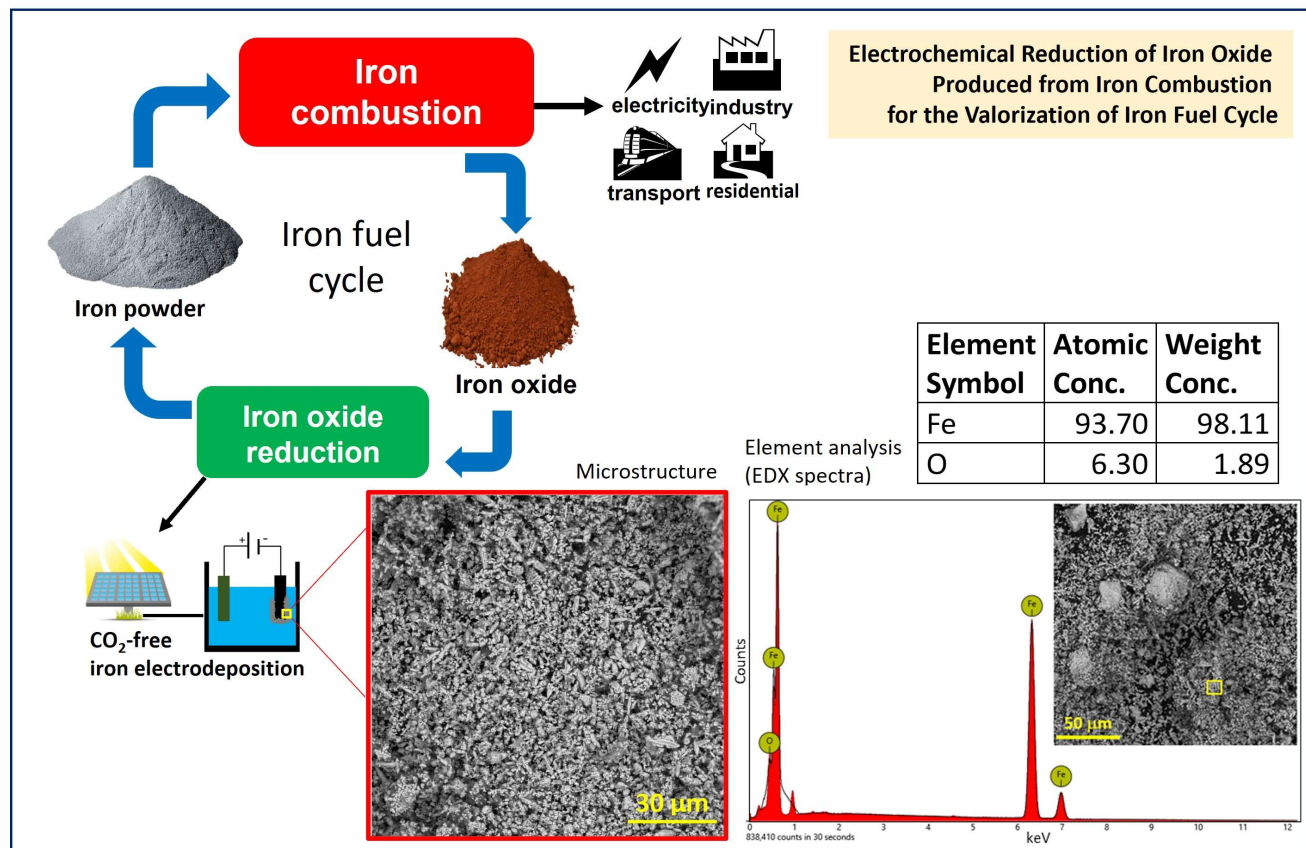
You have submitted the following abstract to 242nd ECS Meeting (October 9-13, 2022). Receipt of this notice does not guarantee that your submission was complete, free of errors, or accepted for presentation.

## Electrochemical Reduction of Iron Oxide - Produced from Iron Combustion - for the Valorization of Iron Fuel Cycle

A. I. Majid (Technische Universiteit Eindhoven), Y. Tang, G. Finotello, J. van der Schaaf, and N. G. Deen (Technische Universiteit Eindhoven, Eindhoven Institute of Renewable Energy System (EIRES))

### Abstract Text:

Iron is a prospective candidate for energy carriers in the energy transition era with high energy density. In this concept, energy is released by the combustion of iron powder whilst the solid product - iron oxide - can be collected and reduced back to metallic iron, forming a recyclable iron fuel cycle. The electrochemical technique is considered to be a suitable reduction method as it has attractive aspects including low electric energy consumption, low temperature, direct usage of renewable energy, and a short process chain. In this study, the performance of iron electrodeposition is investigated using an electrolysis cell containing a suspension of micron-sized combusted iron powder in aqueous NaOH (50%wt, 18 M) at a temperature of 110°C. The parallel plate electrolyzer used in these experiments consists of a stainless-steel plate (cathode) and a nickel gauze (anode). The effects imposed by varying current density, iron oxide composition, and iron oxide particle diameter on Faradaic efficiency and reduced iron yield are evaluated. Additional experiments using a rotating disc electrode (RDE) are also conducted to determine the system's diffusion coefficient under different operating conditions. Generally, cathodic deposition of metallic iron is successfully achieved and the morphology of the deposited iron depends on the operation conditions including the current density and heterogeneity of the flow system. The obtained results open new perspectives for efficient and cost-effective iron production/regeneration.



**Symposium Selection:**

E01 - Electrodeposition for Energy Applications 6

**Submitter's E-mail Address:**

ai.majid@ugm.ac.id

**Preferred Presentation Format:**

Oral

First Corresponding Author

---

Mr. Akmal Irfan Majid

**Affiliation(s):** Technische Universiteit Eindhoven**Address:**

Power and Flow Section, Department of Mechanical Engineering, Eindhoven University of Technology, The Netherlands

Eindhoven, 5612JN

Netherlands

**Phone Number:** +31626245780**E-mail Address:** a.i.majid@tue.nlSecond Author

---

Dr. Yali Tang

**Affiliation(s):** Technische Universiteit Eindhoven; Eindhoven Institute of Renewable Energy System (EIRES)**Phone Number:****E-mail Address:** y.tang2@tue.nlThird Author

---

Dr. Giulia Finotello

**Affiliation(s):** Technische Universiteit Eindhoven; Eindhoven Institute of Renewable Energy System (EIRES)**Phone Number:****E-mail Address:** G.finotello@tue.nlFourth Author

---

Prof. John van der Schaaf

**Affiliation(s):** Technische Universiteit Eindhoven; Eindhoven Institute of Renewable Energy System (EIRES)**Phone Number:****E-mail Address:** j.vanderschaaf@tue.nlFifth Author

---

Prof. Niels Gerbrand Deen

**Affiliation(s):** Technische Universiteit Eindhoven; Eindhoven Institute of Renewable Energy System (EIRES)**Phone Number:****E-mail Address:** n.g.deen@tue.nl

---

**If necessary, you can make changes to your abstract between now and the deadline of [Friday, April 22 2022](#)**

To review or revise your submission prior to the deadline, click on the link below; you may need to log in again with your ECS credentials.

<https://ecs.confex.com/ecs/242/gateway.cgi>

Any changes that you make will be reflected instantly. You DO NOT need to go through all of the submission steps in order to change one thing. If you want to change the title, for example, just click "Title" in the abstract control panel and submit the new title.

When you have completed your submission, you may close this browser window.

[Tell us what you think of the abstract submittal](#)

[Home Page](#)