 **RMW16**

**The 16th Workshop on Reactive Metal Processing**

**March 24 (Fri.) – 25 (Sat.), 2023 @ MIT**

(After TMS 2023, March 19 (Sun.) – 23 (Thu.), 2023 @ San Diego, California)

**Organizers:**

**Donald R. Sadoway**, *Massachusetts Institute of Technology*

**Toru H. Okabe**, *Institute of Industrial Science (IIS),*

 *The University of Tokyo*

**Antoine Allanore**, *Massachusetts Institute of Technology*

**Shunsuke Yagi**, *IIS, The University of Tokyo*

**Program Coordinators:**

**Takanari Ouchi**,*IIS*, *The University of Tokyo*

**Gen Kamimura**,*IIS*, *The University of Tokyo*

**Isaac Oda-Bayliss**,*IIS*, *The University of Tokyo*

**Jonathan Paras**, *Massachusetts Institute of Technology*

Sponsors

-The Rare Metal Research Workshop, one of the Special Research Groups
organized by the Foundation for the Promotion of Industrial Science (FPIS)
(RC-40: directed by Prof. T. H. Okabe)

-Donation to The University of Tokyo New York Office
by Dowa Metals & Mining Co., Ltd., Mitsubishi Materials Corporation,
Sumitomo Metal Mining Co., Ltd., and Tanaka Kikinzoku Kogyo K.K..

- Integrated Research Center for Sustainable Energy and Materials (SUSMAT)

-Institute of Industrial Science, The University of Tokyo (IIS UTokyo SYMPOSIUM No.113)

http://www.okabe.iis.u-tokyo.ac.jp/core-to-core/rmw

The 16th Workshop on Reactive Metal Processing

(IIS UTokyo SYMPOSIUM No.113)

March 24 (Fri.) – March 25 (Sat.), 2023, MIT, Cambridge, MA

Time:

- 1st day: on March 24 (10:00 – 17:00 and Banquet at 18:30)

- 2nd day: on March 25 (10:00 – 14:00)
Refreshments will be served around 9:00 AM on both days.

Venue:

- **Haus Allen Room (MIT)**- **Le Méridien Cambridge**

Registration Fee:

$200 / person

NOTICE: Please prepare to pay the registration fee in cash!

Organizers:

**Prof. Donald R. Sadoway**,*Massachusetts Institute of Technology*

**Prof. Toru H. Okabe**,*IIS, The University of Tokyo*

**Prof. Antoine Allanore**, *Massachusetts Institute of Technology*

**Prof. Shunsuke Yagi**, *IIS, The University of Tokyo*

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 (IIS UTokyo SYMPOSIUM No.113)

Contact:

Isaac Oda-Bayliss, *IIS, The University of Tokyo*

E-mail: aisaku-oda@g.ecc.u-tokyo.ac.jpWorkshop Program

**Day 1**

Morning, March 24 (Friday), 2023 @ Haus Allen Room (MIT)

9:00 – 10:00 **Coffee & Breakfast Service**

10:00 – 10:10 **Opening Remarks**

*Prof. Antoine Allanore*
Massachusetts Institute of Technology

Session Chair: Prof. Antoine Allanore

10:10 – 10:40 **Aluminium-sulfur Battery for Long-duration Stationary Power Delivery**

*Donald R. Sadoway*

Massachusetts Institute of Technology

10:40 – 11:00 **Break**

Session Chair: Dr. Takanari Ouchi

11:00 – 11:30 **Recent Development of Positive Electrode Active Materials for Magnesium Rechargeable Batteries**

*Shunsuke Yagi*

IIS, The University of Tokyo

11:30 – 12:00 **Sulfidation Chemistry for Materials Processing**

*Casper Stinn*

Massachusetts Institute of Technology

12:00 – 13:00 **Lunch**

Session Chair: Prof. Geir Martin Haarberg

13:00 – 13:30 **Anodic Electrochemical Deposition and Its Application**

*Takanari Ouchi*
The University of Tokyo

13:30 – 14:00 **Aluminum Production with Oxygen Evolving Inert Anodes: Some Recent Developments**

*Guðrún Sævarsdóttir*

Reykjavik University, NTNU

14:00 – 14:20 **Photo & Break**

Session Chair: Dr. Gen Kamimura

14:20 – 15:20 **3-min Short Presentation by Poster Presenters**

15:20 – 16:20 **Poster Session at the Haus Room and Allen Room at Building 36**

18:00 – **Reception** @ Le Méridien Cambridge

18:30 – **Banquet** @ Le Méridien Cambridge

**Day 2**

Morning, March 25 (Saturday), 2023 @ Haus Allen Room (MIT)

9:00 – 10:00 **Coffee & Breakfast Service**

10:00 – 10:10 **Opening Remarks**

*Prof. Shunsuke Yagi*

IIS, The University of Tokyo

Session Chair: Prof. Shunsuke Yagi

10:10 – 10:40 **A Magnesium Clean Energy Ecosystem Vision**

*Adam C. Powell IV*

Worcester Polytechnic Institute

10:40 – 11:00 **Break**

Session Chair: Prof. Adam C. Powell IV

11:00 – 11:30 **Proposal for Mg Production in Japan**
*Toshihide Takenaka*
Kansai University

11:30 – 12:00 **Electrowinning of Aluminium and Carbon Footprint**

*Geir Martin Haarberg*

NTNU

12:00 – 12:10 **Information for the Next RMW**

*Prof. Toru H. Okabe*

IIS, The University of Tokyo

12:10 – 12:20 **Closing Remarks**

 *Prof. Donald R. Sadoway*

 Massachusetts Institute of Technology

12:20 – 13:30 **Lunch**

13:30 – **Laboratory Tour (for applicants)**

**List of Poster Presentations**

**1. Investigation of α-MnO2 cathode in Magnesium Rechargeable Batteries**
*Isaac Oda-Bayliss*1,2, *Shunsuke Yagi*2,
1Department of Materials Engineering, Graduate School of Engineering, The University of Tokyo,

2Institute of Industrial Science, The University of Tokyo

**2. Metal Leaching and Multiple Effect Distillation for Neodymium Magnet Recycling**
*Chinenye Chinwego*1*, Emmanuel Offei Opoku*1,
1Worcester Polytechnic Institute

**3. Study of Diaphragm Material used in Na-Zn Liquid Metal battery (LMB) for Stationary Energy Storage***Cathrine KW Solem*1, *Karen S. Osen*1, *Wojciech Gebarowski*1, *Henrik Gudbrandsen*1,

*Ole S. Kjos*1, *Camilla Sommerseth*1,
1SINTEF

**4. Recovery of precious metals from scraps using electrochemical anodic deposition in molten salt electrolyte**
*Yuka Kujiraoka*1,2, *Takanari Ouchi*2, *Toru H. Okabe*2,
1Department of Materials Engineering, Graduate School of Engineering, The University of Tokyo,

2Institute of Industrial Science, The University of Tokyo

**5.  Electrochemical recovery of Au and Ag from ore deposits using innovative Deep Eutectic Solvent ionic liquids**
*Gøril Jahrsengene*1, *Zhaohui Wang*1, *Ana Maria Martinez*1,
1SINTEF

**6. Electrochemical Reduction of Iron Oxide for the Valorizing the Iron Fuel Cycle**
*Akmal Irfan Majid*1,
1Eindhoven University of Technology

**7. Optimization of Ni Electrodeposition for Alkaline Water Electrolyzers**
*Yukihiro Takahashi*1,
1Norwegian University of Science and Technology (NTNU)

**8. Recent technological developments for liquid displacement battery***Kashif Mushtaq*1,1LEPABE, University of Porto, Portugal

**9. Fundamental Study on Effects of Impurity on Zinc Electrowinning in Alkaline Bath**
*Akihiro Kishimoto*1,
1Department of Materials Science and Engineering, Kyoto University

**List of Poster Presentations**

**10. Anodic Behavior of MoSi2 Containing Nb in MgCl2-NaCl-CaCl2 Molten Salt***Shunsuke Irie*1, 1Kansai University Graduate School

**11. Liquid metal Si deposition in molten CaCl2 with the different molar ratio of CaO to SiO2***Kosei Takahashi*1,
1Graduate School of Science and Engineering, Kansai University, Japan

**12. Effect of impurities on Mg Metal Deposition in Molten Salt Electrolysis***Tatsuya Sasaki*1,
1Kansai University Graduate School

**13. Advances in Magnesium Primary Production by Reactive Cathode Molten Salt Electrolysis with G-METS Distillation***Zujian Tang*1*, Daniel McArthur Sehar*1,
1Worcester Polytechnic Institute

**14. Numerical Modeling of Silicon Electrodeposition***Aditya Moudgal*1,
1Worcester Polytechnic Institute

**15. Aluminum Electrolysis with Vertical Inert Electrodes – Recent Developments***Daníel Þór Gunnarsson*1,2, *Guðmundur Gunnarsson*2, *Jón Hjaltalín Magnússon*3,

*Kamaljeet Singh*1,*Rauan Meirbekova*2, *Roman Düssel*4, *Gudrun Sævarsdóttir*1
1Reykjavík University

 2IceTec

 3Arctus Aluminium

4 TRIMET Aluminium SE

**16. Investigation of Steel production via the Sulfide pathway***Kimaya P Suryarao*1,
1Massachusetts Institute of Technology (MIT)

**17. LiF-BeF2 Electrochemistry and Surrogate Materials Selection***Nathan Bradshaw*1,
1Massachusetts Institute of Technology (MIT)

**18. MHD modelling of electric arcs in Submerged Arc Furnaces for Silicon Production***Hákon Valur Haraldsson*1, *Gudrun Sævarsdóttir*1, *Yonatan Afework Tesfahunegn*1,
1Reykjavik University and NTNU

**History of RMW**

2006 **The 1st Workshop on Reactive Metal Processing (RMW1)**

 March 17 (Fri.) - March 19 (Sat.), Cambridge, MIT

2006 **The 2nd Workshop on Reactive Metal Processing (RMW2)**

 November 16 (Thurs.) - November 17 (Fri.), Tokyo, The University of Tokyo

2007 **The 3rd Workshop on Reactive Metal Processing (RMW3)**

 March 2 (Fri.) - March 3 (Sat.), Cambridge, MIT

2008 **The 4th Workshop on Reactive Metal Processing (RMW4)**

 March 14 (Fri.) - March 15 (Sat.), Cambridge, MIT

2010 **The 5th Workshop on Reactive Metal Processing (RMW5)**

 February 18 (Thurs.) - February 19 (Fri.), Seattle, Red Lion Hotel on 5th Avenue

2011 **The 6th Workshop on Reactive Metal Processing (RMW6)**

 March 4 (Fri.) - March 5 (Sat.), Pasadena, Caltech

2012 **The 7th Workshop on Reactive Metal Processing (RMW7)**

 March 16 (Fri.) - March 17 (Sat.), Cambridge, MIT

2013 **The 8th Workshop on Reactive Metal Processing (RMW8)**

 March 8 (Fri.) - March 9 (Sat.), Cambridge, MIT

2014 **The 9th Workshop on Reactive Metal Processing (RMW9)**

 February 21 (Fri.) - February 22 (Sat.), Pasadena, Caltech

2015 **The 10th Workshop on Reactive Metal Processing (RMW10)**

 March 20 (Fri.) - March 21 (Sat.), Cambridge, MIT

2016 **The 11th Workshop on Reactive Metal Processing (RMW11)**

February 19 (Fri.) - February 20 (Sat.), Cambridge, MIT

2017 **The 12th Workshop on Reactive Metal Processing (RMW12)**

 March 3 (Fri.) - March 4 (Sat.), Cambridge, MIT

2018 **The 13th Workshop on Reactive Metal Processing (RMW13)**

 March 16 (Fri.) - March 17 (Sat.), Cambridge, MIT

2019 **The 14th Workshop on Reactive Metal Processing (RMW14)**

 March 15 (Fri.) - March 16 (Sat.), Cambridge, MIT

2020 **The 15th Workshop on Reactive Metal Processing (RMW15)**

February 28 (Fri.) - February 29 (Sat.), San Diego, UC San Diego



**RMW2 in 2006 at IIS**

**RMW1 in 2006 at MIT**

**RMW9 in 2014 at CALTECH**

**RMW5 in 2010 at Seattle**

**RMW15 in 2020 at San Diego**

**List of Participants**

|  |  |  |
| --- | --- | --- |
| Adam C. Powell IV | Associate Professor | Worcester Polytechnic Institute |
| Aditya Moudgal | Graduate Student | Worcester Polytechnic Institute  |
| Akihiro Kishimoto | Assistant Professor | Kyoto University |
| Akmal Irfan Majid | PhD Student | Eindhoven University of Technology |
| Alex Grant | CEO | Magrathea |
| Antoine Allanore | Professor | MIT |
| Ava Waitz | Graduate Research Assistant | MIT |
| Ayaka Sakamoto | Administrative Staff | IIS, The University of Tokyo |
| Brandon Velasquez | PhD Student | Reykjavik University |
| Caspar Stinn | PhD Candidate | MIT |
| Cathrine KW Solem | Research Scientist | SINTEF |
| Charles Boury | PhD Student | MIT |
| Chinenye Chinwego | PhD Candidate | Worcester Polytechnic Institute |
| Daniel McArthur Sehar | PhD Student | Worcester Polytechnic Institute |
| Daníel Þór Gunnarsson | Masters Student | Reykjavik University |
| Donald Sadoway | Chief Scientist | Sadoway Labs |
| Emmanuel Offei | Masters Student | Worcester Polytechnic Institute |
| Ethan Benderly-Kremen | PhD Candidate | Allanore Research Group |
| Geir Martin Haarberg | Professor | NTNU |
| Gen Kamimura | Research Associate | IIS, The University of Tokyo |
| Gøril Jahrsengene | Research Scientist | SINTEF |
| Gudrun Saevarsdottir | Professor | Reykjavik University and NTNU |
| Hákon Valur Haraldsson | PhD Student | Reykjavik University and NTNU |
| Haley Williams | PhD Student | UC Berkeley |
| Hiroyuki Iwasaki | Technical Advisor | KINA Corporation |
| Isaac Oda-Bayliss | Masters Student | IIS, The University of Tokyo |
| Jacob Brown | CTO | Magrathea |
| Jonathan Paras | PhD Student | MIT |
| Jumpei Matsumura | Research Scientist | Japan Aviation Electronics Industry, Ltd. (IIS) |
| Kamaljeet Singh | PhD Student | Reykjavik University and NTNU |
| Kashif Mushtaq | Post-doc Researcher | LEPABE, University of Porto |
| Kimaya P Suryarao | Research Assistant | MIT |
| Kosei Takahashi | Graduate Student | Kansai University Graduate School |
| Lucas Marden | Intern | Magrathea Metals |

**List of Participants**

|  |  |  |
| --- | --- | --- |
| Masatoshi Ueno | Managing Director | Komatsu |
| Nathan Bradshaw | PhD Student | MIT |
| Porter Bowen | Undergraduate researcher | MIT |
| Ragnhild E. Aune | Professor | NTNU |
| Raluca O. Scarlat | Assistant Professor | UC Berkeley |
| Rochelle Zordich | Industry Advisor | WPI EMRG  |
| Shinya Suzuki | Research Scientist | IIS, The University of Tokyo |
| Shunsuke Irie | Graduate Student | Kansai University Graduate School |
| Shunsuke Yagi | Associate Professor | IIS, The University of Tokyo |
| Takanari Ouchi | Lecturer | IIS, The University of Tokyo |
| Tatsuya Sasaki | Graduate Student | Kansai University Graduate School |
| Tomás Villalon Jr. | CTO, Co-Founder | Phoenix Tailings |
| Toru H. Okabe | Professor | IIS, The University of Tokyo |
| Toshihide Takenaka | Professor | Kansai University |
| Yonatan Afework Tesfahunegn | Research Scientist | Reykjavik University |
| Yuhei Terada | Administrative Staff | IIS, The University of Tokyo |
| Yuka Kujiraoka | Graduate Student | IIS, The University of Tokyo |
| Yukihiro Takahashi | PhD Candidate | NTNU |
| Zachary K Adams | Graduate Research Assistant | MIT |
| Zujian Tang | PhD Student | Worcester Polytechnic Institute |

**Venue Details**

Workshop:

Haus Allen Room

Building 36, Room 462 (4th floor)

50 Vassar St, Cambridge, MA 02139

Interactive Campus Map available at: <http://whereis.mit.edu/>

Banquet:

Le Méridien Boston Cambridge

20 Sidney St, Cambridge, MA 02139

