

The 3rd Workshop  
on  
Reactive Metal Processing  
– Recent Progress of Materials Processing –

March 2-3, 2007

Massachusetts Institute of Technology,  
Cambridge, MA, USA



Supported by Core to Core Program “Active Metal Processing”,  
Japan Society for the Promotion of Science (JSPS)  
and  
The John F. Elliott Chair in Materials Chemistry at MIT

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## Welcoming Remarks

The 3rd Workshop on Reactive Metal Processing subtitled “Recent Progress in Materials Processing” is being held at the Massachusetts Institute of Technology (MIT) from March 2 to 3, 2007; this follows the 1st Workshop held in Boston (March 17–19, 2006) and the 2nd Workshop held in Tokyo (November 16–17, 2006). The workshop is jointly organized by the Sadoway Laboratory at MIT and the Okabe Laboratory at the University of Tokyo (UT) under the auspices of an international program titled “Core to Core Program,” which is supported by the Japan Society for the Promotion of Science (JSPS). We extend our warmest welcome to all of your attending the 3rd Workshop.

One of the main intentions of this workshop is to create world-leading research hubs by linking Japan and other advanced countries through the exchange of the latest and excellent researches on reactive metal processing. Further, it provides a world stage for the debut of young researchers who will facilitate the next generation of scientific advances.

In recent years, progress in industrial products and engineering technologies has been remarkable. For the sustainable development of societies, highly advanced functional materials and environmentally sound technologies are required. In particular, owing to their unique properties, the processing fundamentals of reactive metals have received increasing attention by both industrial firms and academic scientists. The 1st and 2nd Workshops offered outstanding lectures by 16 leading international researchers from 7 countries on a wide variety of aspects of reactive metals processing, thereby proving the value of such a forum and validating the vision of the organizers.

We hope that the 3rd Workshop will further contribute to not only develop an active and global partnership among the participants but also formulate future strategies with regard to reactive metals by providing plenty of opportunities for animated discussions.

Finally, we express our sincere appreciation to all the participants for their academic contributions and to the administrative staffs and students of the UT and MIT for their assistance. Financial supports from JSPS and the Elliott Chair are gratefully acknowledged.



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Donald R. Sadoway  
John F. Elliott Professor  
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# Workshop Program

Morning, March 2 (Friday), 2007

Lecture Hall 1-190

AM1, Session chair: Prof. D.R. Sadoway

- 8:00–8:10      **Opening Remarks**  
Prof. D.R. Sadoway, Massachusetts Institute of Technology
- 8:10–8:45      **“Solid-oxide-membrane (SOM) Process for the Production of Reactive Metals”** (doc. A)  
Prof. U.B. Pal, Boston University
- 8:45–9:20      **“Electro-winning of Silicon from Molten Slag and Determination of Inter-diffusivity in the Slag”** (doc. B)  
Prof. M. Kawakami, Toyohashi University of Technology
- 9:20–9:55      **“Sustainable Electrolysis”** (doc. C)  
Prof. G.M. Haarberg, Norwegian University of Science and Technology
- 9:55–10:15     **Break**

AM2, Session chair: Prof. T.H. Okabe

- 10:15–10:50    **“Electrochemical Behavior of Titanium Electrode in TMHA-Tf<sub>2</sub>N Room Temperature Molten Salt”** (doc. D)  
Prof. T. Uda, Kyoto University
- 10:50–11:25    **“Electrolysis Research Activities at SINTEF”** (doc. E)  
Dr. A. Solheim on behalf of Dr. E. Skybakmoen, SINTEF
- 11:25–12:00    **“Direct Electrochemical Production of Titanium”** (doc. F)  
Dr. K. Dring, Norsk Titanium AS
- 12:00–13:15    **Lunch (Von Hippel Room 13-2137)**

Afternoon, March 2 (Friday), 2007

Lecture Hall 1-190

PM1, Session chair: Prof. Y. Sato

13:15–13:50     **“Production, Processing and Utilization of Materials”** (doc. G)  
Prof. G.J. Kipouros, Dalhousie University

13:50–14:25     **“Thermodynamics on SOG-Si Refining Processes”** (doc. H)  
Prof. K. Morita, University of Tokyo

14:25–15:00     **“Research Progress”** (doc. I)  
Prof. H. Zhu, University of Science and Technology Beijing

15:00–15:20     **Break**

PM2, Session chair: Prof. G.J. Kipouros

15:20–15:55     **“Dynamic Behavior of the Interface between Molten and  
Solidified Salt”** (doc. J)  
Dr. A. Solheim, SINTEF

15:55–16:30     **“Development of a Recycling Process for Nickel-metal Hydride  
Batteries ”** (doc. K)  
Dr. M. Miyake, University of Tokyo

16:30–17:05     **“The Principles of Oxygen Electrowinning from Lunar Regolith”**  
(doc. L)  
Prof. D.R. Sadoway, Massachusetts Institute of Technology

17:05–17:45     **Poster Session (Von Hippel Room 13-2137)**

18:00–20:30     **Workshop Reception & Banquet  
(MIT Museum, 265 Massachusetts Avenue)**

Morning, March 3 (Saturday), 2007

Lecture Hall 2-105

AM1, Session chair: Prof. D.R. Sadoway

- 8:00–8:10      **Greetings**  
 Prof. D.R. Sadoway, Massachusetts Institute of Technology
- 8:10–8:25      **“Enrichment of Titanium Subchlorides in Molten Salts”** (doc. M)  
 Dr. O. Takeda, Tohoku University
- 8:25–8:40      **“Cathode Wear in Aluminum Electrolysis”** (doc. N)  
 Ms. K. Vasshaug, Norwegian University of Science and Technology
- 8:40–8:55      **“Reduction of Titanium Oxide to Titanium Alloy by Hydrogen”**  
 (doc. O)  
 Mr. H. Sekimoto, Kyoto University
- 8:55–9:10      **“New Separation and Recovery Process of Platinum Using  
 Chlorinating Agents”** (doc. P)  
 Ms. C. Horike, University of Tokyo
- 9:10–9:25      **Break**

AM2, Session chair: Prof. G.J. Kipouros

- 9:25–9:40      **“Magnesium Processing by Powder Metallurgy”** (doc. Q)  
 Mr. Paul Burke, Dalhousie University
- 9:40–9:55      **“Fundamental Study on Titanium Production Process  
 by the Disproportionation Reactions of Titanium Subchlorides”**  
 (doc. R)  
 Mr. T. Oi, University of Tokyo
- 9:55–10:10      **“New Production Process for Nb Powder by Preform Reduction Process”**  
 (doc. S)  
 Mr. J. Kubo, University of Tokyo
- 10:10–10:25      **“Production of Scandium and Al-Sc Alloy”** (doc. T)  
 Mr. M. Harata, University of Tokyo
- 10:25–10:40      **Break**

AM3, Session chair: Prof. K. Morita

- 10:40–10:55      **“Dissolution Rates of Pt-Zn Intermetallic Compounds in Acid”**  
 (doc. U)  
 Mr. H. Sasaki, University of Tokyo

- 10:55–11:10    **“An Environmentally-sound Process for Recycling Ti Scraps Combining with Chloride Wastes”** (doc. V)  
Ms. H. Zheng, University of Tokyo
- 11:10–11:25    **“Thermodynamic Measurement for Cr-P Alloy with Double Knudsen Cell Mass Spectrometry”** (doc. W)  
Mr. T. Nagai, University of Tokyo
- 11:25–11:40    **“Electrochemical Formation of Self-organized Nanotubes/Nanorods”** (doc. X)  
Dr. K. Yasuda, University of Tokyo
- 11:40–11:55    **“Electrodeoxidation of TiO<sub>2</sub> in Molten CaCl<sub>2</sub>”** (doc. Y)  
Mr. O. Kjos, Norwegian University of Science and Technology
- 12:00–13:00    **Workshop Lunch (Von Hippel Room 13-2137)**

Afternoon, March 3 (Saturday), 2007                      Lecture Hall 2-105

PM1, Session chair: Prof. T. Uda

- 13:00–13:20    **“Molten Oxide Electrolysis: Towards “Green” Steelmaking & Lunar *in situ* Resource Utilization”** (doc. Z)  
Visiting Prof. D. Wang, Massachusetts Institute of Technology
- 13:20–13:40    **“Production of Liquid Titanium by Molten Oxide Electrolysis”**  
(doc. AA)  
Dr. C. Dealwis, Massachusetts Institute of Technology
- 13:40–14:00    **“Electrode Processes Associated with the Electrolytic Production of Ni in Molten Oxides”** (doc. AB)  
Visiting Prof. B. Li, Massachusetts Institute of Technology
- 14:00–14:20    **“Electrodeposition of Diamondlike Carbon Films”** (doc. AC)  
Dr. A.H.C. Sirk, Massachusetts Institute of Technology
- 14:20–14:30    **Closing Remarks**  
Prof. D.R. Sadoway, Massachusetts Institute of Technology
- 14:30–14:45    **Adjourn**
- 14:45–16:00    **Tour of Sadoway Laboratory and MIT Campus**
- 16:00            **Depart**

## Digest of Poster Presentations

**“Dehydration Behavior of Superprotonic Conductor CsH<sub>2</sub>PO<sub>4</sub>”** (doc. AD)

Y. Taninouchi, T. Uda and Y. Awakura

**“Processing and Microstructure of Doped Barium Zirconate and Its Phase Relationship”** (doc. AE)

S. Imashuku, T. Uda and Y. Awakura

**“Electrochemical Behavior of Titanium Electrode in TMHA-Tf<sub>2</sub>N Room Temperature Molten Salt”** (doc. AF)

H. Nakagawa, T. Uda, K. Murase and Y. Awakura

**“Reduction of Titanium Oxide to Titanium Alloy by Hydrogen”** (doc. AG)

H. Sekimoto, R. Shioi, T. Uda, S. Sato and Y. Awakura

**“Thermodynamic Measurement for Cr-P Alloy with Double Knudsen Cell Mass Spectrometry”** (doc. AH)

T. Nagai, M. Miyake and M. Maeda

**“Dissolution Rates of Pt-Zn Intermetallic Compounds in Acid”** (doc. AI)

H. Sasaki, M. Miyake and M. Maeda

**“Production of Scandium and Al-Sc Alloy”** (doc. AJ)

M. Harata, T. Nakamura, H. Yakushiji and T.H. Okabe

**“New Production Process for Nb Powder by Preform Reduction Process”**  
(doc. AK)

J. Kubo and T.H. Okabe

**“Fundamental Study on Titanium Production Process by the Disproportionation Reactions of Titanium Subchlorides”** (doc. AL)

T. Oi and T.H. Okabe



**“New Separation and Recovery Process of Platinum Using Chlorinating Agents”**

(doc. AM)

C. Horike and T.H. Okabe

**“Selective Chlorination of Titanium Ore and Production of Titanium Powder  
by Preform Reduction Process” (doc. AN)**

H. Zheng and T.H. Okabe

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