

**Third Information Exchange Meeting on
the Nuclear Production of Hydrogen**
including Second HTTR Workshop

Japan Atomic Energy Agency (JAEA), Oarai, Japan
5 - 7 October 2005

Wednesday, 5 October

< Shuttle bus : Mito (8:00) to Oarai-site, registration (8:30-9:00) >

09:00-09:15 **Opening**
T. Dujardin, OECD/NEA
O.OYAMADA, JAEA

Session 1: The Prospects for Hydrogen in Future Energy Structures and Nuclear Power's role.

Chaired by M.C.Petri (ANL)

- 1 09:15 *M. Hori (NSA), M. Numata, T. Amaya, Y. Fujimura*
Synergy of Fossil Fuels and Nuclear Energy for the Energy Future
- 2 09:40 *G. Rothwell (Stanford Univ.), E. Bertel*
Can Nuclear Power Compete in the Hydrogen Economy?
- 3 10:05 *S.Shiozawa (JAEA)*
Future Plan on Environmentally Friendly Hydrogen Production by Nuclear Energy

BREAK 10:30-10:50

Session 2: The Status of Nuclear Hydrogen Research and Development Efforts around the Globe.

Chaired by M. Methnani (IAEA) /W.A.Summers (SRNL)

- 4 10:50 *M. Hori (NSA), S. Shiozawa*
Research and Development for Nuclear Production of Hydrogen in Japan
- 5 11:15 *D. Henderson (DOE), A. Taylor*
The U.S. Department of Energy Research and Development Program on Hydrogen Production Using Nuclear Energy
- 6 11:40 *F. Le Naour (CEA)*
An Overview of the CEA Road-map for Hydrogen Production

LUNCH 12:15 - 13:20

Chaired by M. Methnani (IAEA) /W.A.Summers (SRNL)

- 7 13:20 *Y. Sun (INET), Y. Zhang, J. Chen, Y. Xu, J. Xu, Z. Zhang*
R&D Effort on Nuclear Hydrogen Production Technology in China
- 8 13:45 *A.I. Miller (AECL)*
Hydrogen: An Update on Canadian Activities

- 9 14:10 Y.J. Shin (KAERI), J.H. Kim, J.H. Chang, W.S. Park, J.K. Park
Nuclear Hydrogen Production Project in Korea
- 10 14:35 K. Verfondern (FZ-Juelich), W. von Lensa
Michelangelo Network Recommendations on Nuclear Hydrogen Production

BREAK 15:00 – 15:15

Session 3: Integrated Nuclear Hydrogen Production Systems.

Chaired by A. Miller (AECL) / K. Verfondern (FZ-Juelich)

- 11 15:15 X.L. Yan (JAEA), K. Kunitomi, R. Hino
GTHTR300 Design Variants for Production of Electricity, Hydrogen, or Both
- 12 15:40 M. Richards (GA), A. Shenoy, K. Schultz, L. Brown, E. Harvego, F. Okamoto, N. Handa
H₂-MHR Conceptual Designs Based on the SI Process and H T E
- 13 16:05 P. Anzieu (CEA) P. Aujollet, D. Barbier, A. Bassi, F. Bertrand, A. Le Duigou, J. Leybros, G. Rodriguez
Coupling a Hydrogen Production Process to a Nuclear Reactor
- 14 16:30 T. Iyoku (JAEA), N. Sakaba, S. Nakagawa, Y. Tachibana, S. Kasahara, K. Kawasaki
HTTR Test Program towards Coupling with the IS Process
- 15 16:55 H. Ohashi (JAEA), Y. Inaba, T. Nishihara, T. Takeda, K. Hayashi, Y. Inagaki
Current Status of Research and Development on System Integration Technology for Connection between HTGR and Hydrogen Production System at JAERI

PHOTOGRAPH 17:25

< Shuttle bus : Oarai-site -- Asahi-bunshitsu -- Mito >

DINNER at Asahi-bunshitsu, 18:00 - 20 :00

< Shuttle bus : Asahi-bunshitsu to Mito >

Thursday, 6 October

< Shuttle bus : Mito (8:20) to Oarai-site >

Session 4: Nuclear Hydrogen Technologies and Design Concepts.

Chaired by K.Kunitomi(JAEA) / J.S.Herring (INL)

- 16 09:00 K. Onuki (JAEA), S. Kubo, A. Terada, N. Sakaba, R. Hino
Study on Thermochemical Iodine-Sulfur Process at JAERI
- 17 09:25 S. Kubo (JAEA), S. Shimizu, H. Nakajima, K. Onuki
Studies on Continuous and Closed-cycle Hydrogen Production by Thermo-chemical Water-splitting Iodine-Sulfur Process at JAERI
- 18 09:50 A. Terada, Y. Imai, H. Noguchi, H. Ota, A. Kanagawa, S. Ishikura, S. Kubo, J. Iwatsuki, K. Onuki, R. Hino (JAEA)
Experimental and Analytical Results on H₂SO₄ and SO₃ Decomposers

- 19 10:15 *M.A. Lewis, M.C. Petri (ANL), J.G. Masin,*
A Scoping Flowsheet Methodology for Evaluating Alternative Thermochemical Cycles

BREAK 10:40 – 11:00

Chaired by K.Kunitomi(JAEA) / J.S.Herring (INL)

- 20 11:00 *S. Suppiah (AECL), J. Li, R. Sadhankar, M. Lewis*
Study of the Hybrid Cu-Cl Cycle for Nuclear Hydrogen Production
- 21 11:25 *M.A. Khan, Y.T. Chen (Univ. Nevada)*
Preliminary Process Analysis and Simulation of Thermo-chemical Hydrogen Generation Using Copper-Chlorine Cycle
- 22 11:50 *W.A. Summers (SRNL), M.B. Gorenssek, M.R. Buckner*
The Hybrid Sulfur Cycle for Nuclear Hydrogen Production

LUNCH 12:15 - 13:20

Chaired by Y.J. Shin (KAERI) / T.Takeda (JAEA)

- 23 13:20 *P. Anzieu (CEA), P. Carles, A. Le Duigou, X. Vitart, F. Lemort*
The Sulfur-Iodine and Others Thermochemical Processes Studies at CEA
- 24 13:45 *K.K. Bae (KIER), G.J. Hwang, C.S. Park, C.H. Kim, S.H. Lee*
A Study on Hydrogen Production by Thermochemical Water-splitting IS Process
- 25 14:10 *P. Zhang (INET), B. Yu, J. Xu*
Present Research Status and Development Plan of Nuclear Hydrogen Production Programme in INET

BREAK 14:35 - 14:55

Chaired by Y.J. Shin (KAERI) / T.Takeda (JAEA)

- 26 14:55 *T. Nakagiri (JAEA), T. Kase, S. Kato, K. Aoto*
Development of the Thermochemical and Electrolytic Hybrid Hydrogen Production Process for Sodium Cooled FBR
- 27 15:20 *J.S. Herring (INL), J.E. O'Brien, C.M. Stoots, G.L. Hawkes, P. Lessing, W. Windes, D. Wendt, M.Mc. Kellar, M.A. Sohal, J.J. Hartvigsen*
Progress in High-temperature Electrolysis for Hydrogen Production
- 28 15:45 *Y. Kato (TITech)*
Possibility of a Chemical Hydrogen Carrier System Based on Nuclear Power

BREAK 16:10 - 16:30

Session 5: Basic and Applied Science in Support of Nuclear Hydrogen Production.

Chaired by Y.Kato(TITech)

- 29 16:30 *C.H. Kim (KIER), G.J. Hwang, C.S. Park, S.H. Lee, B.K. Kim, K.K. Bae*
A Study on the HI Concentration by Polymer Electrolyte Membrane Electrodialysis

- 30 16:55 *H.S. Choi (Kyungil Univ.), G.J. Hwang, C.S. Park, K.K. Bae, H.J. Kim*
The Preparation Characteristics of Hydrogen Permselective Membrane for Higher Performance in IS Process of Nuclear Hydrogen Production

< Shuttle bus : Oarai-site to Mito >

Friday, 7 October

< Shuttle bus : Mito (8:20) to Oarai-site >

Session 5 (continued):

Chaired by P.Anzieu (CEA) / Y.Sun (INET)

- 31 09:00 *H. Karasawa (Hitachi), A. Sasahira, K. Hoshino*
Thermal Decomposition of SO₃
- 32 09:25 *S. Fukada (Kyushu Univ.), K. Onoda, S. Suemori*
Direct Energy Conversion by Proton-conducting Ceramic Fuel Cell Supplied with CH₄ and H₂O at 600 – 800°C
- 33 09:50 *M. Ozawa (JAEA), R. Fujita, T. Suzuki, Y. Fujii*
Separation and Utilization of Rare Metal Fission Products in Nuclear Fuel Cycle as for Hydrogen Production Catalysts

BREAK 10:15 - 10:35

Chaired by P.Anzieu (CEA) / Y.Sun (INET)

- 34 10:35 *H. Kawamura, M. Mori, S.Z. Chu (CRIEPI), M. Uotani*
Electrical Conductive Perovskite Anodes in Sulfur-based Hybrid Cycle
- 35 11:00 *Y. Izumizaki (TITech), K.C. Park, Y. Tachibana, H. Tomiyasu, Y. Fujii*
Generation of H₂ by Decomposition of Pulp in Supercritical Water with Ruthenium(IV) Oxide Catalyst

11:30-12:00 **Discussions and Preparation of Recommendations for the Path Forward**
Chaired by R.Hino (JAEA) / M.C.Petri (ANL)

End of the NEA meeting ; 12:10

12:15-13:20 LUNCH

< Shuttle bus : Oarai-site -- bus stop for Rose liner -- Mito >

Special session in the framework of second HTTR workshop (pm, 7 October)

- 13:20-14:50 **JAEA's R&D Activities on Gas Turbine, Fuel etc.**
Presentation by *K. Sawa / JAEA / Japan*
S. Nakagawa / JAEA / Japan
Y. Tachibana / JAEAI / Japan
S. Takada / JAEA / Japan
(Chairman *T.Iyoku / JAEA / Japan*)
- 14:50-15:05 BREAK

15:05-15:20 **Concluding Remarks**
Y. Komori / JAEA / Japan

15:20-16:50 **Technical Tour ; HTTR and Hydrogen Production Apparatus**

< Shuttle bus : Oarai-site to Mito >