

# Conference Programme STEELYHYDROGEN

27/09 - 19h **Welcome Drink & Registration**

## DAY 1 - September 28<sup>th</sup>

7h30-8h20 **Registration at the MSC facilities**

8h20-8h30 **Welcome and Introduction**

### **Keynote lecture**

08h30-9h15 **Hydrogen Embrittlement:  
Observation and Mechanism in Wide Range of Strength and Microstructure**

**Yukitaka Murakami, Saburo Matsuoka**

International Institute for Carbon-Neutral Energy Research (I2CNER), Kyushu University  
Research Center for Hydrogen Industrial Use and Storage (HYDROGENIUS), Japan  
National Institute of Advanced Industrial Science and Technology (AIST), Japan  
Department of Mechanical Engineering, Kyushu University, Japan

### **Session 1: Hydrogen Embrittlement of (Ultra) High Strength Steels (1)**

- 9h15-09h45 Hydrogen embrittlement of Zn, Zn-Ni and Cd coated high strength steel  
K. R. Sriraman, S. Yue  
S. Brahim  
J. A. Szpunar  
Department of Mining & Materials Engineering, McGill University, Montreal, Canada  
IBECA Technologies, Montreal, Canada  
Department of Mechanical Engineering, University of Saskatchewan, Saskatoon, Canada
- 09h45-10h15 In-situ mechanical evaluation of hydrogen embrittlement for TRIP, FB, DP and HSLA steels  
T. Depover, D. Pérez Escobar, E. Wallaert, M. Verhaege  
L. Duprez  
K. Verbeken  
Department of Materials Science and Engineering, Ghent University, Ghent, Belgium  
ArcelorMittal Global R&D Gent, Zelzate, Belgium  
Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany
- 10h15-10h45 Influence of Microstructure on the Susceptibility to Hydrogen Embrittlement  
R.G. Thiessen, T. Heller  
K. Mraczek, A. Nitschke, A. Pichler  
ThyssenKrupp Steel Europe AG, Germany  
voestalpine Stahl GmbH, Austria
- 10h45-11h00 Coffee Break**

## **Session 2: The Hydrogen Management inside Steels (1)**

- 11h00-11h30 Hydrogen diffusion and trapping in steels and related embrittlement effects  
Jacques Chêne  
UMR CEA-CNRS n° 8587 - CEA, DEN, DPC, SCCME, Laboratoire d'Étude de la Corrosion  
Aqueuse, Gif-Sur-Yvette Cedex, France
- 11h30-12h00 Thermal Desorption Analysis of Pre-Strained TRIP Steel Charged with Hydrogen  
J.A. Ronevich, J.G. Speer, D.K. Matlock  
B.C. DeCooman  
Advanced Steel Processing and Products Research Center, Department of Metallurgical  
and Materials Engineering, Colorado School of Mines, Golden, Colorado, USA  
Materials Design Laboratory, Graduate Institute of Ferrous Technology, Pohang University  
of Science and Technology, Pohang, South Korea
- 12h00-12h30 Measurement and modelling of hydrogen desorption in Alusi coated boron steel  
C. Georges, T. Machado, P. Drillet, T. Sturel, T. Vietoris  
Centre for Research in Metallurgy – CRM Group, Liège, Belgium,  
ArcelorMittal Research Maizières, Maizières-les-Metz, France,  
ArcelorMittal Research Berlin, Berlin, Germany
- 12h30-13h00 Ab initio investigation of hydrogen solubility and mobility in steels  
T. Hickel, R. Nazarov, J. von Pezold, M. Friák, J. Neugebauer  
L. Ismer  
Computational Materials Design, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf,  
Germany  
Materials Department, University of California, Santa Barbara, CA, USA

**13h00-14h00 Lunch**

## **Session 3: Welding and Mechanical Testing Methods**

- 14h00-14h30 Novel Control of Weld Metal Hydrogen Cracking in the Welding of Thick Steels  
J. M. Nicholas and R. J. Pargeter  
TWI Ltd, United Kingdom
- 14h30-15h00 Weld Metal Hydrogen Cracking in High-Strength Multipass Welds - Precautions for Safe  
Welding  
Nevasmaa Pekka  
Technical Research Centre of Finland, Finland
- 15h00-15h30 Hydrogen Diffusion and Critical Stress Intensity in an X70 Pipeline Steel Hyperbaric Welded  
Joint - Experiments & FE simulation.  
A. Alvaro, V. Olden, O. M. Akselsen  
Department of Engineering Design and Materials, NTNU, Trondheim, Norway  
SINTEF Materials and Chemistry, Trondheim, Norway

**15h30-15h45 Coffee Break**

- 15h45-16h15 Constant Load Testing with In-Situ hydrogen Charging on Martensitic Ultra High Strength  
 L. Duprez, M. Arafin, F. Van den Abeele, N. Bernier  
 D. B. Rosado  
 J. De Mey, V. Van Speybroeck  
 ArcelorMittal Global R&D Gent, Zelzate, Belgium  
 Universidade Federal do Rio Grande do Sul, PPGE3M, Brasil  
 Center for molecular modeling, Ghent University, Ghent, Belgium
- 16h15-16h45 Fracture Mechanics Techniques for Assessing the Effects of Hydrogen on Steel Properties  
 M. J. Cheaitani and R. J. Pargeter  
 TWI Ltd, United Kingdom
- 16h45-17h15 In Situ Nanoindentation Testing of Hydrogen Degradation on Super Duplex Stainless Steel  
 A. Basa, C. Thaulow, V. Olden  
 Department of Engineering Design and Materials, NTNU, Norway  
 Department of Applied Mechanics and Corrosion, SINTEF, Norway

### Visit of the facilities of the Metals Structure Centre

### Conference Dinner

## DAY 2 - September 29<sup>th</sup>

### Session 4: Hydrogen Embrittlement of (Ultra) High Strength Steels (2)

- 8h30-9h00 Influence of High Pressure Gaseous Hydrogen on the Mechanical Properties of Austenitic Stainless Steels  
 T. Michler  
 J. Naumann  
 Adam Opel AG, GM Europe Science Laboratory, Ruesselsheim, Germany  
 BMW AG, Munich, Germany
- 9h00-9h30 The Development of the K7<sup>r</sup> Model for the Prediction of Stress Corrosion Cracking in Austenitic TWIP Steels  
 P. Cugy, P. Dietsch, J. Goncalves  
 C.P. Scott  
 ArcelorMittal Research Maizières, Maizières-lès-Metz, France  
 AREVA (NP), Lyon, France
- 9h30-10h00 Hydrogen Delayed Fracture of AHSS for Automotive Application  
 S. K. Kim, P. Y. Oh, S. H. Jeon, S. H. Han, S. E. Kang, K.-G. Chin, J. R. Scully  
 Technical Research Laboratory, POSCO, Gwangyang-si, Jeonnam, Korea  
 Materials Science & Engineering, University of Virginia, VA, USA
- 10h00-10h30 Delayed Fracture in CrNi- and Mn- based Austenitic Steels: Effects of Austenite Stability, Hydrogen and Tensile Strain Rate  
 X. Guo, W. Bleck  
 Department of Ferrous Metallurgy, RWTH Aachen University, Aachen, Germany

### 10h30-10h45 *Coffee Break*

## Session 5: Hydrogen Embrittlement of (Ultra) High Strength Steels (3)

10h45-11h15 "MultiHy": an EU-FP7-NMP Project on Multiscale Modelling of Hydrogen Embrittlement  
N. Winzer, M. Mrovec  
A. Paxton  
Fraunhofer Institute for Mechanics of Materials IWM, Freiburg, Germany  
Queen's University Belfast, Belfast, UK

11h15-11h45 H-embrittlement mechanisms in 34CrMo4 martensitic steels  
L. Moli-Sanchez, J. Chêne  
F. Martin  
E. Leunis  
CNRS/CEA UMR 8587, LECA – CEA Saclay, Gif sur Yvette, France  
CEA, DEN, DPC, SCCME, Laboratoire d'Etude de la Corrosion Aqueuse, Gif sur Yvette, France  
OCAS NV, Gent, Belgium

11h45-12h15 Hydrogen Embrittlement on Advanced High Strength Martensitic Steels for Automotive  
G. Lovicu, M. De Sanctis, A. Dimatteo, R. Valentini  
M. Bottazzi, F. D'Aiuto  
C. Santus  
Dipartimento di Ingegneria Chimica, Chimica Industriale e Scienza dei Materiali - Università di Pisa, Italy  
Centro Ricerche Fiat Scpa, Orbassano (TO), Italy  
Dipartimento di Ingegneria Meccanica, Nucleare e della Produzione - Università di Pisa, Italy

12h15-12h45 Effect of Material Characteristics on Hydrogen Embrittlement of Steel Fasteners  
S. Brahim  
IBECA Technologies, Montreal, Canada  
Department of Mining & Materials Engineering, McGill University, Montreal, Canada

**12h45-13h45 Lunch**

## Session 6: The Hydrogen Management inside Steels (2)

13h45-14h15 Influence of Electro-Galvanising Parameters on Absorbed Hydrogen Content in AHSS  
R.G. Thiessen, K. Bergers, T. Heller  
ThyssenKrupp Steel Europe AG, Germany

14h15-14h45 Some advances on hydrogen diffusion and trapping in relation with stress field and microstructural defects  
A. Oudriss, S. Frappart, I. Legrand, J. Bouhattate, J. Creus, C. Savall, X. Feaugas  
Laboratoire d'Etude des Matériaux en Milieu Agressif, EA 3167, Université de la Rochelle, La Rochelle, France

14h45-15h15 Hydrogen solubility and diffusion in austenitic stainless steels studied with thermal desorption and mechanical loss spectroscopy  
Y. Yagodzinsky, O. Todoshchenko, S. Papula, M. Ivanchenko, H. Hänninen  
Laboratory of Engineering Materials, School of Engineering, Aalto University, Aalto, Finland

**15h15-15h30 Coffee Break**

- 15h30-16h00 Hydrogen Trapping and its Effect on Permeation and Thermal Desorption  
R. Kirchheim  
Institut für Materialphysik - Georg-August-Universität Göttingen, Germany
- 16h00-16h30 Study of the hydrogen traps in a high strength TRIP steel by Thermal Desorption Spectroscopy, X-ray Diffraction and Differential Scanning Calorimetry  
D.Pérez Escobar, M. Verhaege  
L. Duprez  
K. Verbeken  
Department of Materials Science and Engineering, Ghent University, Gent, Belgium  
ArcelorMittal Global R&D Gent, Zelzate, Belgium  
Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany

***Conclusions and closure of the conference***