

**9^e COLLOQUE INTERNATIONAL SUR LA CORROSION ET LA PROTECTION
DES MATERIAUX A HAUTE TEMPERATURE**

**9th INTERNATIONAL SYMPOSIUM ON HIGH-TEMPERATURE CORROSION
AND PROTECTION OF MATERIALS**

Les EMBIEZ (Var) France – Mai/May 15-20, 2016

PROGRAMME-PROGRAM

DIMANCHE 15 MAI – SUNDAY MAY 15

14h-19h 30 Welcome of Participants (Hotel Hélios Front desk)

18h 30 Apéritif de bienvenue - Gathering Wine and Cheese party

19h 30



DINNER

20h 30

Ouverture et Présentation du Colloque - Symposium Opening and Opening Addresses
Daniel Monceau, Bruce Pint

OPENING CONFERENCE

Chairmen: Bruce PINT / Daniel MONCEAU

21h15 Invited plenary lectures :

A unified view of deposit-induced corrosion

J. M. ALVARADO-OROZCO, J. E. GARCIA-HERRERA L. GARCIA-FRESNILLO B. S. LUTZ, and G H MEIER*
*University of Pittsburgh, USA

Accelerated corrosion by carbon under both reducing and oxidising conditions

D.J. YOUNG and J. ZHANG

University of New South Wales, Sydney, Australia

Mise en place des posters des sessions A+B+C -Posters from sessions A+B+C to be put in place

LUNDI 16 MAI – MONDAY MAY 16

SESSION A

FUNDAMENTALS

Chairmen: Gerald MEIER / Clara DESGRANGES

8h30 **PLENARY lecture: A thermodynamic approach to guide reactive element doping: Hf additions to NiCrAl (214)**

Thomas GHENO*, Bi-Cheng ZHOU, Austin ROSS, Xuan LIU, Greta LINDWALL, Zi-Kui LIU, Brian GLEESON

* University of Pittsburgh, USA

9h10 **Keynote lecture: Oxide scales grown on wrought NiCrAl-base alloys: from protectiveness to breakaway oxidation (242)**

Anton CHYRKIN*, Rishi PILLAI, Nooshin MORTAZAVI, Mats HALVARSSON, Daniel GRUNER, Joseph W. QUADAKKERS

* Forschungszentrum Jülich GmbH, Germany

9h40 **Keynote lecture: Internal Oxidation in Dry And Wet Conditions for Oxygen Permeability of Fe-Ni Alloys at 1,150°C and 1,100°C (162)**
[Aurélien PRILLIEUX*](#), Domingo JULLIAN, Jianqiang ZHANG, Daniel MONCEAU, David J. YOUNG
* School of Materials Science and Engineering, UNSW Australia / CIRIMAT, ENSIACET, Toulouse France

10h10



PAUSE CAFE – COFFEE BREAK

Chairmen: Yves WOUTERS / Dmitry NAUMENKO

10h30 **PLENARY lecture: Kinetic and structural processes affecting Al₂O₃-scale establishment during early-stage oxidation on Ni-base alloys (291)**

[Brian GLEESON*](#), Yihong, KANG, Wei ZHAO, Juan M. ALVARADO-OROZCO
* University of Pittsburgh, USA

11h10 **Keynote lecture: Properties of alumina/chromia scales in N₂ – Containing low oxygen activity environment investigated by experiment and theory (191)**

[Christine GEERS*](#), Vedad BABIC, Nooshin MORTAZAVI, Mats HALVARSSON, Bo JONSSON, Lars G. JOHANSSON, Itai PANAS, Jan E. SVENSSON
* Chalmers University of Technology, Sweden

11h40 **Keynote lecture: Characterization and lifetime estimation of a binary Ni-30Cr alloy Oxidized at 1150°C in oxygenated atmospheres ranging from 10⁻¹³ to 10⁻³ ATM O₂ (146)**

[Eric SCHMUCKER*](#), Carine PETITJEAN, Pierre-Jean PANTEIX, Laure MARTINELLI, Sabah BEN LAGHA, Michel VILASI
* Institut Jean Lamour, France / AREVA NC, France

12h10



LUNCH

After lunch

Séance posters des sessions A+B+C - Poster presentations from sessions A+B+C

16h 30



PAUSE CAFE – COFFEE BREAK

17h **Keynote lecture: Oxidation after breakaway oxidation of stainless steels at high temperature – Generic properties of FeCr(Ni) alloys (276)**

[Torbjörn JONSSON*](#), Sten KARLSSON, Hamed HOOSHYAR, Mohammad SATTARI, Jesper LISKE, Jan E. SVENSSON, Lars G. JOHANSSON
* Chalmers University of Technology, Sweden

17h30

Keynote lecture: Influence of surface finishes on oxidation mechanisms of the ferritic stainless steel K41 for the solid oxide fuel cell and high temperature electrolysis interconnect application (145)

[Pauline GIRARDON*](#), Sébastien TAHON, Pierre-Olivier SANTACREU, Jean-Michel DAMASSE
* APERAM, France

SESSION B

CORROSION IN C-CONTAINING ATMOSPHERES

Chairmen: David D. YOUNG / Fabien ROUILLARD

18h **Keynote lecture: Oxidation behaviour of nickel-chromium alloys in CO₂ atmosphere at 700°C (110)**

Thuan NGUYEN, Yun XIE, Shijie DING, [Jianqiang ZHANG*](#), David J. YOUNG
* UNSW, Australia

18h 30 **Keynote lecture: Relevance of carbon activity in defining the severity of a metal dusting environment (240)**

[Aurélie ROUAIX*](#), Aurélien FABAS, Sébastien DOUBLET, Daniel MONCEAU
* Institut Carnot CIRIMAT, France

19h 00



DINNER

21-22h

Séance posters des sessions A+B+C - Poster presentations from sessions A+B+C

MARDI 17 MAI – TUESDAY MAY 17

Before lunch

Mise en place des posters des sessions D+F – Posters from sessions D+F to be put in place

SESSION C

OXIDATION IN WATER VAPOR

Chairmen: Brian GLEESON / Sébastien CHEVALIER

PLENARY lecture: Characterization of high-temperature material stability in water vapor utilizing a steam-jet furnace (225)

8h30

[Elizabeth OPILA](#)
University of Virginia, USA

Keynote lecture: The effect of water vapor on the formation of FeCr₂O₄ by solid state reaction of Fe and Cr₂O₃ at 1073K (237)

9h10

[Mitsutoshi UEDA*](#), Kotaro WATANABE, Toshio MARUYAMA, Masao TAKEYAMA
** Department of Metallurgy and Ceramics Science, Tokyo Institute of Technology, Japan*

Keynote lecture: Effect of water vapor on the adherence at room temperature of alumina scales developed over aluminized superalloy (130)

9h40

[Gilles BONNET*](#), Maxime BROSSARD, Fernando PEDRAZA
** University of La Rochelle, France*



10h10

PAUSE CAFE – COFFEE BREAK

Keynote lecture: Dual atmosphere effect on ferritic stainless steels – An inverse temperature effect (246)

10h30

[Patrik ALNEGREN](#), [Jan-Erik SVENSSON](#)
Chalmers University of Technology, Sweden

SESSION D

HIGH TEMPERATURE CORROSION AND MIXED OXIDANT (PART I)

Chairmen: Lars-Gunnar JOHANSSON / Jean-Michel BROSSARD

Keynote lecture: Effect of strengthening additions in a cast Ni-base superalloy on its oxidation resistance in oxidizing-sulfidizing environments (253)

11h

[Dmitry NAUMENKO*](#), Aleksandra JALOWICKA, Wojciech NOWAK, Joseph W. QUADAKKERS
** Forschungszentrum Jülich GmbH, Germany*

Keynote lecture: Validation of hot corrosion risk model for gas turbine blading by ex-service components with thermal barrier coatings (270)

11h30

[Bettina BORDENET*](#), Wenke KONIG, Karl-Johan STEFANSSON
** General Electric, Switzerland*

12h



LUNCH


After
lunch

Séance posters des sessions D+F - Poster presentations from sessions D+F

SESSION D

HIGH TEMPERATURE CORROSION AND MIXED OXIDANT (PART II)

Chairmen: *Michael SPIEGEL / Michel VILASI*

- 17h** **Keynote Lecture: High temperature corrosion resistance of Cr/Ni alloy on a carbonate molten salt for solar applications (192)**
*Isabel LASANTA, Teresa DE MIGUEL, Gustavo GARCIA MARTIN, Victor ENCINAS SANCHEZ, Francisco Javier PEREZ TRUJILLO**
** Grupo de Ingeniería de Superficies y Materiales Nanoestructurados, Universidad Complutense de Madrid, Spain*
- 17h30** **Keynote lecture: The impact of microstructure on the corrosion of alloy 617 mod. in coal fired plants (275)**
Michael SPIEGEL, Miriam LANGE*
** Salzgitter Mannesmann Forschung GmbH, Germany*
- 18h** **Keynote lecture: Chlorine attack of carbon steel between 350-500°C and its importance regarding corrosion in waste incineration (178)**
Mathias Christian GALETZ, Ludmila KONRAD*
** Dechema Forschungsinstitut, Germany*
- 18h30** **Keynote lecture: Fireside corrosion of self-fluxing coating protection in WTE plant: effect of flue-gas and metal temperature (209)**
Fares MAAD, Jean-Michel BROSSARD, Jérôme CHARTIER, Rémi CHAVROT, Yuzou KAWAHARA*
** Veolia Recherche et Innovation, France*
- 19h** **Keynote lecture: NaCl induced high temperature corrosion of Ti alloys (142)**
Clément CISZAK, Ioana POPA, Jean-Michel BROSSARD, Daniel MONCEAU, Sébastien CHEVALIER*
** ICB CNRS, University of Bourgogne, France*
- 19h30**  **DINNER**
- 21h** **Invited lecture: Future directions in the field of high temperature corrosion research**
Michael SCHUETZE and Joe QUADAKKERS***
**Dechema Forschungsinstitut **Forschungszentrum Juelich.*
- 22h-23h** **Séance posters des sessions D+F - Poster presentations from sessions D+F**

MERCREDI 18 MAI – WEDNESDAY MAY 18

Before
lunch

Mise en place des posters des sessions E+G+H – Posters from sessions E+G+H to be put in place

SESSION E

MECHANICAL ASPECTS OF HIGH TEMPERATURE OXIDATION

Chairmen: *David SHIFLER / Eric ANDRIEU*

- 8h 30** **PLENARY Lecture: Effect of strain on the high-temperature oxidation of Inconel[®] 740[®] and Haynes[®] 282[®] (231)**
Peter F. TORTORELLI, Kinga A. UNOCIC*
** Oak Ridge National Laboratory, USA*
- 9h10** **Keynote lecture: Assesment of a mechanical model associated with oxide scale growth on T91 steel at 550°C under wet atmosphere (269)**
Marie-Christine DEMIZIEUX, Jérôme FAVERGEON, Laure MARTINELLI, Clara DESGRANGES*
** University of Technology of Compiègne, France*

Keynote lecture: Recent research on the oxidation of recycled and conventional hot-rolled carbon steels and their scale adhesion: a review (119)

9h 40

[Somrerak CHANDRA-AMBHORN*](#), Jennarong TUNGTRONGPAIROJ, Tanongsak SOMPHAKDEE, Anuwat JUTILARPTAVORN, Yasumitsu KONDO, Hiroshi TANEI, Thinnakorn PHADUNGWONG

* King Mongkut's University of Technology North Bangkok, Thailand

10h10



PAUSE CAFE – COFFEE BREAK

10h 30

Keynote lecture: Intergranular oxidation effects during dwell-time fatigue of high-strength superalloys (218)

[Ulrich KRUPP*](#), Ken WACKERMANN, Hans-Jürgen CHRIST, Magnus HORNQVIST COLLIANDER, Krystyna STILLER

*University of Applied Sciences Osnabrück, Germany

SESSION F

PROTECTIVE COATINGS AND THERMAL BARRIER COATINGS (PART I)

Chairmen: Bruce PINT / Stéphane MATHIEU

11h

Keynote lecture: Aluminum solid solution coating for high temperature corrosion protection (201)

[Alina AGUERO*](#), Marcos GUTIERREZ, Raúl MUELAS

*INTA, Spain

11h30

Keynote lecture: Oxidation protection of SS304 by nano-sized powders modified organic silicone coatings (266)

[Cheng WANG](#)

Institute of Metal Research, China

12h



LUNCH

After
lunch

Après-midi libre -Unstructured afternoon

Social activities are planned for this afternoon.

17h00



PAUSE CAFE – COFFEE BREAK

SESSION F

PROTECTIVE COATINGS AND THERMAL BARRIER COATINGS (PART II)

Chairmen: John Nicholls / Fernando PEDRAZA

17h30

Keynote lecture: Evaluation of aluminide coatings as hardfacing material candidate in sodium fast reactor (177)

[Fabien ROUILLARD*](#), Brigitte DUPREY, Stéphane MATHIEU, Michel VILASI, Younes BOUIZI, Jean-Bernard VOGT, Ingrid PRORIOL-SERRE, Germain BOISSONNET, Fernando PEDRAZA

*CEA, DEN, SCCME, LECNA, University of Paris, France

18h

Keynote lecture: CMAS-induced degradation of adhesion of thermal barrier coatings (215)

[Vladimir TOLPYGO](#)

Honeywell Aerospace, USA

18h30

Keynote lecture: Water vapor effects on CMAS degradation of thermal barrier coatings (132)

[Bradley LUTZ*](#), R. Wesley JACKSON, Najeb ABDUL-JABBAR, Vladimir TOLPYGO, Carlos G. LEVI

*University of California, USA

19h00

PLENARY lecture: Accelerated aging of yttria-stabilized zirconia thermal barrier coatings in high water vapor content, elevates temperature environments (238)

Timothy J. MONTALBANO, [Daniel R. MUMM*](#)

*University of California, USA



BANQUET

20h

Special Keynote: Historic view of high temperature corrosion

[Alain GALERIE](#)

Grenoble Institute of Technology, France

JEUDI 19 MAI – THURSDAY MAY 19

SESSION G

OXIDATION OF NEW MATERIALS AND COMPOSITES

Chairmen: John PEREPEZKO / Francis REBILLAT

Keynote lecture: High temperature oxidation behavior of refractory high entropy alloys: effect of alloy composition (175)

9h [Bronislava GORR*](#), Franz MUELLER, Hans-Jürgen CHRIST, Hans CHEN, Martin HEILMAIER

**University of Siegen, Germany*

Keynote lecture: Novel SiC/SiC CMCs with high resistance against oxidation in air (252)

9h30 [Kazuya SHIMODA*](#), Tatsuya HINOKI, Hideyuki MURAKAMI

**National Institute for Materials Science, Japan*



10h

PAUSE CAFE – COFFEE BREAK

Keynote lecture: Design of a self-healing thermal barrier coating for prolonged lifetime (200)

10h30 [Willem G. SLOOF](#)

Delft University of Technology, Netherlands

Keynote lecture: High-temperature properties of self-healing metal/oxide nanocomposites (167)

11h [Makoto NANKO](#)

Nagaoka University of Technology, Japan

Keynote lecture: High temperature decomposition of an Fe and Cr doped NiO produced by a novel flame spray technique (204)

11h 30 Mark DUFFIELD, [Gordon J. TATLOCK*](#), John LEWIS

**University of Liverpool, UK*

12h



LUNCH

14h-15h30

TIME SLOT RESERVED TO ORGANIZE BUSINESS MEETINGS (use this time slot at your convenience to organize parallel business meetings)

CEFRACOR meeting.

After noon **Séance posters des sessions E+G+H -Poster presentations of sessions E+G+H**




16h40

PAUSE CAFE – COFFEE BREAK

SESSION H

ADVANCED CHARACTERIZATION TECHNIQUES (PART I)

Chairmen: Philippe MARCUS / Tony FRY

- 17h **PLENARY lecture: Grain boundary chemistry and transport through alumina scales on an atomic scale (165)**
[Torben BOLL*](#), Kinga A. UNOCIC, Bruce A. PINT, Krystyna STILLER
**Chalmers University of Technology, Sweden*
- 17h40 **Keynote lecture: Interfacial chemistry in thermally grown alumina (249)**
Yimeng CHEN, Roger C. REED, [Emmanuelle A. MARQUIS](#)
**University of Michigan, USA*
- 18h10 **Keynote lecture: In-situ monitoring of zirconium carbide oxidation (800°C-1200°C) using a high temperature environmental SEM (277)**
[Claudia GASPARRINI*](#), Renaud PODOR, Denis HORLAIT, William Edward LEE
**Imperial College London, UK*
- 18h40 **Keynote lecture: NiAl oxidation reaction processes studied in situ using mems-based-closed-cell gas reaction transmission electron microscopy methods (255)**
[Kinga A. UNOCIC*](#), Larry F. ALLARD, Bruce A. PINT
**ORNL, USA*
- 19h10  **DINNER**
- 21-22h **Séance posters des sessions E+G+H - Poster presentations of sessions E+G+H**

VENDREDI 20 MAI – FRIDAY MAY 20

SESSION H

ADVANCED CHARACTERIZATION TECHNIQUES (PART II)

Chairmen: Shigenari HAYASHI / Gordon TATLOCK

- 8h30 **Keynote lecture: Recent advances in in situ investigation of oxidation of metals and alloys using TOF-sims (294)**
[Philippe MARCUS](#)
CNRS-Chmie Paris Tech, France
- 9h **Keynote lecture: Intergranular oxidation of nickel base alloys: potentialities of focused ion beam tomography (199)**
[Cécilie DUHAMEL*](#), Jacqueline CABALLERO, Thierry COUVANT, Jérôme CREPIN, Fabrice GASLAIN, Catherine GUERRE, Hong-Thai LE, Mickaël WEHBI
**Mines Paris Tech, France*
- 9h 30 **Keynote lecture: Photoelectrochemical and STEM/EDX investigations on an oxide scale grown on a chromia-forming alloy under very low oxygen partial pressure: a complex oxide scale (104)**
[Laurence LATU-ROMAIN*](#), Youcef MADI, Stéphane MATHIEU, Jean-Pierre PETIT, Yves WOUTERS
**University of Grenoble SIMaP Laboratory, France*
- 10h **BEST POSTER AWARD PRESENTATION Intern'l Jury**

CONCLUSIONS OF THE SYMPOSIUM

10h 10

- *Highlights of scientific conclusions from the conference (XXX)*
- *Analysis of the survey (Bruce PINT)*
- *Conclusion (Bruce PINT)*

12h



LUNCH (optional, with reservation)