Tue 25 September 2012

09:10 Welcome
T H Hyde
University of Nottingham

09:20 Keynote 1
R Thomison
Loughborough University

10:10 Applicability of handbook crack propagation methods on TIG and Laser welded IN718 at room and elevated temperature for mixed mode loading and dwell-time conditions
T Månsson, M Hörnqvist, T Hansson, H Backström
Volvo Aero Corporation

11:00 Assessment of the Resistance to Weld Solidification Cracking of X65 Pipeline Steel Using a Transvarestraint Test
L Aucott¹, Shuwen Wen ², A Sullivan ², Hongbiao Dong ¹
¹University of Leicester, ²Tata Steel, UK

Session A1 – Design Codes, Standards and Weld Assessment Procedures

Session B1 – Fatigue and Creep-Fatigue Life Assessment

10:00 Improvements to Creep Fatigue Life Assessment of Alloy 800 High Temperature Retention Bolts
D Knowles¹, O Montgomery¹, D Dean²
¹Atkins, ²EDF Energy

10:35 Refreshments

11:00 Application of the linear matching method to creep-fatigue failure analysis of cruciform weldment manufactured of the austenitic steel AISI type 316N(L)
Y Gorash, Haofeng Chen
University of Strathclyde, Dep. of Mechanical & Aerospace Engineering
Session A2  -Weld Repair Performance

11:20  Discussion

11:25  The Weld Repair of Grade 91 Steel Without Post Weld Heat Treatment
       S J Brett¹ & K C Mitchell²
       ¹University of Nottingham, UK
       ²RWE npower

11:25  Internal Fatigue Fracture of an Austenitic Stainless Steel under High Temperature and High Cycle Region
       Y Takahashi, K Kanazawa, M Sugimoto
       Chuo University

11:45  Discussion

11:50  Weld Repairs in CrMoV Pipework Systems
       S J Brett
       University of Nottingham

11:50  Fracture energy model for prediction of creep-fatigue life in 9Cr martensitic steel
       Y Nagae
       Japan Atomic Energy Agency

12:10  Discussion

12:15  Weld repairs and component integrity issues
       D G Robertson and C Smith
       European Technology Development, Leatherhead, Surrey, UK

12:15  The Effect of Strain Rate on Low Cycle Fatigue with Hold Time in 9 Cr Rotor Steel
       Kuk-Cheol Kim, Young-Wha Ma, Byeong-Ook Kong, Min-Soo Kim and Sung-Tae Kang
       Doosan Heavy Industries & Construction, Co Ltd

12:35  Discussion

12:40  Lunch

Session A3 – Development of weld materials for high temperature service (1)

14:00  The efficiency of precipitation strengthening to HAZ of welded joints in W containing high Cr ferritic creep resistant steels
       T Sato¹, Y Hasegawa²
       ¹Touhoku University, ²Nippon Steel Corporation

14:00  High temperature low cycle fatigue behaviour of service-aged P91 material
       T Farragher¹, C Hyde², Wei Sun², T H Hyde², N O’Dowd³, S Scully³, S Leen¹
       ¹NUI Galway, ²University of Nottingham
       ³University of Limerick, ⁴ESB Energy International

14:20  Discussion
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<th>Location</th>
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| 14:25 | B2      | Micro-mechanical analysis of creep behaviour in a multipass weld      | I Lvov, K Naumenko and H Altenbach
Otto von Guericke University
Magdeburg                                                                 | National Institute for Materials Science                                       |
| 14:45 |         | Discussion                                                            |                                                                                                                                          |                                        |
| 14:50 | B3      | The use of refractory metals in high temperature and corrosive        | C E D Rowe
Cedar Metals Limited                                                                                          |                                        |
|       |         | environments                                                          |                                                                                                                                          |                                        |
| 15:10 |         | Discussion                                                            |                                                                                                                                          |                                        |
| 15:15 | B3      | Creep Softening and Damage Process in Creep Strength Enhanced Ferritic| F Masuyama and T Yamaguchi
Kyushu Institute of Technology                                                                                   |                                        |
|       |         | Steels                                                                 |                                                                                                                                          |                                        |
| 15:35 |         | Discussion                                                            |                                                                                                                                          |                                        |
| 15:40 |         | Refreshments                                                          |                                                                                                                                          |                                        |
| 16:00 | B3      | Using small punch test data to determine creep strain and strength    | S Holmström¹, P Auerkari¹ R Hurst¹, D Blagoeva³
¹VTT Technical Research Center of Finland, ²Swansea University, ³Nuclear research and Consultancy Group (NRG)The Netherlands |
|       |         | reduction properties for heat affected zones                         |                                                                                                                                          |                                        |
| 16:20 |         | Discussion                                                            |                                                                                                                                          |                                        |
| 16:00 | A4      | Residual stress evaluation of a Ni based weld metal in the as welded   | A Skouras, M J Pavier, M Peel, P Flewitt
University of Bristol                                                                                           |                                        |
|       |         | and PWHT condition using the neutron diffraction method               |                                                                                                                                          |                                        |
| 16:20 |         | Discussion                                                            |                                                                                                                                          |                                        |
| 16:00 | A4      | Creep-Fatigue Crack Development in Dissimilar Metal Welded Joints     | F Ehrhardt¹,²,³ S R Holdsworth¹, I Kühn³, E Mazza¹,²
²EMPA, ³ETH Zürich, ³ALSTOM Power                                                                                     |                                        |
<p>|       |         | between Steels and a Nickel Base Alloy                                |                                                                                                                                          |                                        |
|       |         |                                                                       |                                                                                                                                          |                                        |</p>
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<tr>
<th>Time</th>
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<tr>
<td>16:25</td>
<td>The Development of Finite Element Modelling Techniques to Determine Residual</td>
<td>S Bate, S May, K Stone, N Shallcross, I Symington</td>
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<td>Stresses in Ferritic Welds</td>
<td>Serco</td>
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<td>16:25</td>
<td>Difficulties in Interpreting Data from Creep Crack Growth Tests on Type 316H</td>
<td>D W Dean and L Allport</td>
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<td>Weldments</td>
<td>EDF Energy Nuclear Generation Ltd</td>
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<td>16:45</td>
<td>Discussion</td>
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<tr>
<td>16:50</td>
<td>FE Simulation of Welding Residual Stresses in P91 and P92 Steel Pipes</td>
<td>A H Yaghi, T H Hyde, A A Becker and W Sun</td>
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<td>University of Nottingham</td>
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<td>16:50</td>
<td>Relationships between microstructure and grain boundary sliding during high-</td>
<td>K Thibault(^1)*, D Locq(^1), P Caron(^1), D Boivin(^1), Y Renollet(^1), Y Bréchet(^2)</td>
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<td>temperature creep of a nickel-based superalloy</td>
<td>(^1) Onera – The French Aerospace Lab, (^2) SIMaP – INPG</td>
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<td>17:10</td>
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<td>17:15</td>
<td>Effect of creep deformation on Z-phase formation in Gr.91 steel</td>
<td>K Sawada, H Kushima, M Tabuchi, K Kimura</td>
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<td>National Institute for Materials Science</td>
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<td>17:25</td>
<td>Discussion</td>
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<td>17:30</td>
<td>Welcome Drinks Reception</td>
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Wed 26 September 2012

09.00  **Keynote 2**  
Fracture Mechanics Based assessment of high temperature failure in welds  
K Nikbin  
Imperial College London

09.00  **Application of modern creep lifing techniques to a γ-TiAl alloy (Ti-45Al-2Mn-2Nb)**  
Z Abdallah¹, M T Whittaker¹, M R Bache¹, M Dixon²  
¹Swansea University, ²Rolls-Royce plc

09:20  **Discussion**

09:25  **Creep Life Assessment of Steam Methane Reformer Outlet Headers and Pigtails**  
C E Jaske and S R Finneran  
Det Norske Veritas (USA), Inc.

09:45  **Discussion**

09:50  **Natural PWSCC Crack Growth in Dissimilar Metal Welds With Inlay**  
F W Brust, S Kalyanam, D-J Shim  
Engineering Mechanics Corporation of Columbus

09:50  **Lifting of a polycrystalline nickel alloy under TMF loading**  
M T Whittaker, R J Lancaster, C J Pretty, J P Jones  
Swansea University

10:10  **Discussion**

10:15  **Evaluation of Fracture Mechanics Parameters for Bi-Material Compact Tension Specimens**  
Haoliang Zhou*, A Mehmanparast, C M Davies, K M Nikbin  
Imperial College London

10:15  **Creep life assessment of graphitised steam pipes**  
K Chalk  
European Technology Development, Leatherhead, Surrey, UK

10:35  **Discussion**

10:40  **Refreshments**

11:00  **C* integrals for a P91 pipe weld with circumferential cracks subjected to internal pressure and end load**  
F Cortellino¹,², T H Hyde¹, W Sun¹, C Pappalettere²  
¹University of Nottingham, ²Politecnico di Bari

11:00  **Analysis of PWR Hot Leg in Severe Accident Conditions: Creep Rupture and Tensile Instability Initiation Modeling**  
H J Rathbun¹, M L Benson¹, R M Iyengar¹, F W Brust²  
¹U.S. Nuclear Regulatory Commission, ²Engineering Mechanics Corporation of Columbus

**Session A5 – High temperature cracks in welds**

**Session B6 – Materials Performance in Nuclear Applications**
11:20  Discussion

Session A6 – Specialised test methods for weldments and material properties

11:25  Nanoindentation characterisation of P91 steel weldments mechanical properties and creep behaviour at operational temperatures
M Davies¹, N Everitt²
¹Micro Materials Ltd, ²University of Nottingham

11:45  Discussion

11:50  Measurement of local creep properties in stainless steel welds
Y Sakanashi, S Gungor, J Bouchard
The Open University

11:50  Creep behavior of plasma nitrided Ti6Al-4V alloy
V M C A Oliveira, C G Pinto, M C L Silva, P A Suzuki, M J R Barboza
Escola de Engenharia de Lorena, EEL-USP

12:10  Discussion

12:15  Use of Electrical Discharge Sampling Equipment for weld and base metal integrity assessment
J Fernandes, C Smith
European Technology Development, Leatherhead, Surrey, UK

12:15  Analysis on microstructural evolution of PtAl diffusion coating on Ni-based superalloy influenced by creep process
Kang Yuan¹, ², Ru Lin Peng¹, Xin-Hai Li², L Johansson³, S Johansson³, Yan-dong Wang³
¹Linköping University, ²Siemens Industrial Turbomachinery AB, ³Beijing Institute of Technology

12:35  Discussion

12:40  Lunch

13:40  Role of Composition in the Dynamic Strain Ageing and Creep Behaviour of 304 Stainless Steel
A. Wisbey, C Austin and L McVey
High Temperature Materials, AMEC Technical Services

14:00  Discussion
Session A7 – Development of weld materials for high temperature service (2)

14:05 Selecting and Measuring the Grain Size of Alloy 800H for Creep Applications
P Tait¹, M V Kral²
¹Methanex Corporation
²University of Canterbury

14:05 A new model for creep damage analysis and its application to creep crack growth simulations
Jian-Feng Wen¹,², Shan-Tung Tu³, Xin-Lin Gao ³, J N Reddy²
¹East China University of Science and Technology, ²Texas A&M University
³University of Texas at Dallas

Session B8 – Fracture and Damage at elevated temperature (1)

14:05 Discussion

14:30 Creep Deformation, Rupture and Ductility of Esshete 1250 Weld Metal.
M W Spindler and S L Spindler
EDF Energy

14:30 Experimental Analysis of Micro-Macro Creep Damage of Notched Specimens for P92 Steel
H Shigeyama, R Sugiura, T Matsuzaki, A Toshimitsu Yokobori Jr
Tohoku University

14:55 Discussion

15:00 Study of the cyclic thermal shock behaviour of welded joints
D Morán¹, A Fernández², C Palleiro³, Víctor Pintos³
¹AIMEN Technology Centre, ²ENCE Pontevedra, ³AIMEN Technology Centre
To be presented by Aurora Lopez

15:00 Guided wave transducer development for high temperature applications
A Mohimi, Tat-Hean Gan, W Balachandran and C Selcuk
Brunel University

15:15 Discussion

15:20 Discussion

15:40 Discussion

15:45 Discussion

15:45 Refreshments
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<th>Session A8 – Modelling and analysis methods for welds at high temperatures (1)</th>
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<tr>
<td>16:00</td>
<td><strong>Creep Life Prediction for HAZ of Mod. 9Cr-1Mo Steels under Multi-axial Stress Conditions</strong></td>
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<td>K Yoshidaa(^1), M Yatomi(^1), M Tabuchib(^2) and K Kobayashic(^3)</td>
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<td>(^1)IHI Corporation</td>
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<td>(^2)National Institute of Materials Science</td>
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<td>(^3)Chiba University</td>
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<td>16:00</td>
<td><strong>Change in Gamma Prime Morphology and Dislocation Substructure of Single Crystal Ni-based Superalloy CMSX-4</strong></td>
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<td>Prior-crept at 1273K-400MPa with Simple Aging</td>
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<td>N Miura, K Kurita and Y Kondo</td>
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<td>The National Defence Academy</td>
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<td>16:20</td>
<td>Discussion</td>
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<td><strong>Creep-fatigue interaction testing of an experimental directionally solidified nickel-based superalloy</strong></td>
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<td>16:50</td>
<td><strong>Analysis of Damage Behaviour Based on the EBSD Method under Creep-Fatigue Conditions for Polycrystalline Nickel-base Superalloys</strong></td>
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<td>D Kobayash(^1), M Miyabe(^1), Y Kagiya(^1), Y Nagumo(^2), R Sugiura(^2), T Matsuzaki(^2) and A T Yokobori Jr (^2)</td>
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<td>(^1)Chubu Electric Power Co. Inc., (^2)Tohoku University</td>
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<td>17:15</td>
<td><strong>Creep behaviour of Waspaloy under non-constant stress and temperature</strong></td>
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<td>W J Harrison, M T Whittaker, C Deen</td>
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<td>Swansea University</td>
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<td>17:35</td>
<td>Discussion</td>
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<td>Pre-dinner Reception</td>
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<td>17:00</td>
<td>Conference Dinner</td>
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Thur 27 September 2012

Session B10 – Computational modelling of creep damage and fracture

09:00  Multi-axial Application of a Hyperbolic Sine Unified Viscoelasticity Constitutive Model to P91 Steel
R A Barrett\textsuperscript{1,3}, P E O’Donoghue\textsuperscript{2,3}, S B Leen\textsuperscript{1,3}
\textsuperscript{1} Mechanical and Biomedical Engineering, College of Engineering and Informatics, NUI Galway,
\textsuperscript{2} Civil Engineering, College of Engineering and Informatics, NUI Galway,
\textsuperscript{3} Ryan Institute for Environmental, Marine and Energy Research, NUI Galway

09:20  Discussion

09:25  Keynote 3
Creep-fatigue performance of 9Cr martensitic steel welded components
A Shibli
European Technology Development, Leatherhead, UK

09:45  Discussion

09:50  Modelling of Creep Crack Growth in Power Plant Steels using the Liu and Murakami Damage Model
C J Hyde, W Sun, T H Hyde, M Saber and A A Becker
University of Nottingham

10:10  Discussion
**Session A9 – High temperature testing, material data, microstructure and characterisation**  

10:15 **Effect of Welding by Induction on Microstructures and Mechanical Properties of an Industrial Low Carbon Steel**  
L Lakhdar¹, B Zakaria²  
¹University, ²LMSM, Biskra University

10:15 **A Strain Rate Dependent Model to Simulate Creep Crack initiation and Growth and Application to 316H Creep Fracture at 550°C**  
N H Kim¹, Y J Kim¹*, C M Davies², K M Nikbin² and D W Dean³  
¹Mechanical Engineering, Korea University, Korea, ²Mechanical engineering, Imperial College, UK  
³EDF Energy, UK

10:35 Discussion

10:40 Refreshments

11:00 **Characterisation of dissimilar welds between ferritic/martensitic steels and Ni-base alloy**  
M Speicher, T Klein, F Kauffmann, A Klenk, K Maile  
Materialprüfungsanstalt Universität Stuttgart

11:00 **A Computational Study of Oxygen Diffusion and Crack Growth for a Nickel-Based Superalloy under Fatigue-Oxidation Conditions**  
A Karabela¹, L G Zhao¹, B Lin¹, J Tong¹, M C Hardy²  
¹University of Portsmouth, ²Rolls-Royce plc

11:20 Discussion

11:25 **Modelling of creep in friction stir welded copper**  
R Sandström¹², H Östling², Lai-Zhe Jina¹  
¹Royal Institute of Technology (KTH), ²Swerea KIMAB

11:25 **Effective optimisation procedures for determining the Chaboche unified visco-plasticity model material constants from isothermal P91 steel experimental data**  
J P Rouse*, C J Hyde, W Sun, T H Hyde  
University of Nottingham

11:45 Discussion

11:50 **Creep Damage Modelling of a P92 Pipe Weld at 675°C**  
D W J Tanner, M Puliyathan, W Sun and T H Hyde  
University of Nottingham

11:50 ‘CRACKFIT’ - procedure & software for crack assessments in low and high temperature industrial plants  
F Akther and S Haligonghde  
European Technology Development, Leatherhead, Surrey, UK

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**Session B11 – Fracture and Damage at elevated temperature (2)**

11:00 **Characterisation of dissimilar welds between ferritic/martensitic steels and Ni-base alloy**  
M Speicher, T Klein, F Kauffmann, A Klenk, K Maile  
Materialprüfungsanstalt Universität Stuttgart

11:00 **A Computational Study of Oxygen Diffusion and Crack Growth for a Nickel-Based Superalloy under Fatigue-Oxidation Conditions**  
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European Technology Development, Leatherhead, Surrey, UK
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<td>12:10</td>
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<td>12:15</td>
<td>Elevated temperature nano-mechanical characterisation of welds in aluminium alloys for multi-scale thermo-mechanical fatigue model optimisation</td>
<td>V Farinha Marques, D De Bono, T London, TWI Ltd</td>
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<td>12:35</td>
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<td>12:40</td>
<td>Lunch and Depart</td>
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<td>12:15</td>
<td>Creep Crack Growth Predictions of Mod. 9Cr-1Mo at 600OC</td>
<td>N H Kim(^1), J J Han(^1), Y J Kim(^1), W G Kim(^2), H Y Lee(^2)</td>
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<td></td>
<td>1 Mechanical engineering, Korea University, Korea</td>
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<td>2 Korea Atomic Energy Research institute, Korea</td>
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