

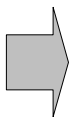
INTRODUCTION TO THE CONFERENCE

Changes in the operating environments of many industrial sectors involving components / structures operating at high temperatures have determined the need to fully exploit advances in knowledge relating to the creep and fracture of the engineering materials they employ. Increased competition and cost awareness in combination with the imposition of environmental regulations have had a significant impact on technological requirements for power-generation, petrochemical, process and waste incineration plant, and the drive units for land based and aero-spatial transport. These trends have given rise to a sharp interest in improving output, performance, efficiency and reliability. An important consequence of this situation has been, and continues to be, the development of new advanced high temperature materials that can operate under more extreme conditions of temperature and stress. It has also meant a drive for the development of less conservative design codes based on more sophisticated methodologies involving state-of-the-art uniaxial and multi-axial creep strain and ductility concepts.

The conference coincides with the end of the third (Advanced-Creep) phase of activity of the European Creep Collaborative Committee (ECCC). The 'Advanced-Creep' project has focused on the analysis of creep strength and ductility data for new and ex-service materials and the application of such knowledge to the defect-free and defect assessment of high temperature components and multi-axial feature specimens. An additional part of this activity has been the evaluation of creep crack initiation (incubation) and growth assessment procedures. The timing of the conference therefore provides an ideal opportunity to critically appraise the state-of-the-art concerning design and life assessment issues relating to creep and fracture in high temperature components.

As the leading voice of industry-based creep specialists in Europe, ECCC has joined forces with key experts from North America, Japan and elsewhere to bring together engineers and researchers from around the world to present the latest developments in all aspects of creep behaviour of high temperature industrial materials and components with the aim of consolidating existing knowledge and identifying future work items requiring attention by the high temperature community.

The Conference is a major international gathering involving key specialists invited from industry, research institutes and academia.



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European Technology Development at:
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PRESENTATIONS

- Oral presentations will be of 20 minutes duration including discussion.
- Keynote papers will be of 40 minutes duration including discussion.

For all *technical enquiries* please contact:

Dr I A Shibli, ETD Ltd., 2 Warwick Gardens, Ashted, Surrey KT21 2HR, UK.
Tel: + 44 (0) 1372 802 555 Fax: + 44 1372 229 164 E.mail: ashibli@etd1.co.uk

PUBLICATION: Copies of the **Proceedings** will be provided at the Conference.

CONFERENCE ORGANISING COMMITTEE

- Dr S R Holdsworth, Alstom Power, UK- Conference Co-Chairman
- Dr T-U Kern, Siemens, Germany- Conference Co-Chairman
- Prof R Viswanathan, EPRI, USA
- Prof R Ainsworth, British Energy, UK
- Dr G Merckling, ISB, Italy - Chairman ECCC
- Dr I A Shibli, ETD, UK – “Advanced Creep” project Co-ordinator
- Dr D G Robertson, ETD, UK- Conference Secretariat
- Dr K Yagi, NIMS, Tsukuba, Japan

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- Prof B Dyson, Imperial College, London
- Dr J Ewald, Ex-Siemens, Germany
- Dr J Hald, Technical University of Denmark / Elsam, Denmark
- Prof T Hyde, School of Management & Mechanical Engineering, Nottingham University, UK
- Dr A Klenk, MPA Stuttgart, Germany
- Prof F Masuyama, Kyushu Institute of Technology/Mitsubishi Heavy Industry, Japan
- Dipl.-Ing. K-H Mayer, Ex-Alstom Energie, Nuremberg, Germany
- Dr I Nonaka, IHI, Japan
- Prof J D Parker, SIA, USA
- Prof A Pineau, Centre des Matériaux - Ecole des Mines, Evry Cedex, France
- Prof R Sandström, KIMAB, Sweden
- M W Spindler, British Energy, UK
- Prof B Wilshire, University of Wales, Swansea, UK

EUROPEAN CREEP COLLABORATIVE COMMITTEE

The European Creep Collaborative Committee (ECCC) is the leading voice of European creep experts from industry and research organisations. Since 1991 ECCC has been engaged in co-ordinating Europe-wide creep data generation, collation and assessment. In particular, the aim is to pool national data resources to provide the optimum basis for rupture strength values for European Product and Design Standards. The products studied are: ferritic/ martensitic and austenitic stainless steels used in high temperature plant and Ni-based alloys used primarily in turbine blades. ECCC is an industry led grouping at present comprising 47 organisations from 16 countries of Europe. Alloy producers, plant designers/ manufacturers and plant operators are all represented.

During the period 1992-1996, ECCC concentrated its efforts on creep-rupture properties of non-welded materials. Between 1997 and 2001 focus switched to the consideration of properties for welded materials. Current ECCC activity is focused on the EC and European industry funded project 'Advanced Creep' which is looking at material properties such as creep ductility, creep strain, multi-axiality, component testing and modelling etc. Work undertaken in these projects resulted in the development and publication of (i) extensive ECCC guidelines on data generation, exchange and assessment methods and (ii) approved Data Sheets on a scale never seen before.

ECCC is also involved in large scale creep / rupture testing of new steels (such as ASME P91, P92 etc.), and other materials where gaps in data have been identified. ECCC work has resulted in the development of new concepts such as creep data qualification for use in design and life assessment. For further information on ECCC or its current project 'Advanced Creep' please visit www.etc1.co.uk/eccc/advancedcreep

ECCC Member Organisations Participating in the Project 'Advanced Creep'			
ETD	UK	E.ON	UK
MPA Stuttgart	DE	SKODA	CZ
Siemens	DE	Corus	UK
Alstom (Rugby)	UK	Technical Universität Graz	AT
ISB	IT	VDEh	DE
CESI	IT	ESB	IE
Tech Universität Darmstadt	DE	SPG	DE
ERA	UK	VTT	FI
British Energy	UK	WRI (VUZ)	SK
Electricite de France	FR	BZF	HU
INASMET	ES	Mitsui Babcock Energy	UK
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Elsam A/S	DK	CEA	FR
CSM	IT	Univ. Poli. delle Marche	IT
SZMF	DE	GMS	NL
VITKOVICE	CZ	NLR	NL
ISQ	PT	Laborelec	BE
SDF	IT	MAN Turbomaschinen	DE
SVUM	CZ	ISPESL	IT
IIS	IT	Vallourec	FR
Poli. di Milano	IT	GKSS	DE
Alstom (Whetstone)	UK	ExxonMobil	NL
RWE npower	UK		

DAY 1

Monday, 12th September 2005

REGISTRATION 0830 - 0920 hrs
WELCOME 0920 - 0930



Day1 Theme: MICROSTRUCTURAL STUDIES AND PRACTICAL IMPLICATIONS FOR HIGH TEMPERATURE INDUSTRIAL STRUCTURES

Keynote Paper 1

0930 - 1010

Long-term creep rupture strength assessment: The development of the European Creep Collaborative Committee Post Assessment Tests

G Merckling, Chairman ECCC, ISB, Italy

Keynote Paper 2

1010 - 1050

Microstructure and long-term creep properties of 9-12%Cr steels

J Hald, ELSAM / Energy E2 / DTU, Denmark

Coffee

1050 - 1120 h

SESSION 1: New High Temperature Plant Materials

1120 - 1240

Coordinator: J Hald

- 1 U.S. program on materials technology for ultrasupercritical coal power plants**
R Viswanathan, EPRI; J F Henry, Alstom; J Tanzosh, B&W; G Stanko, Foster Wheeler; J Shingledecker, ORNL; B Vitalis, Riley Power, USA
- 2 Improvement of long-term creep rupture strength of 9-11% Cr ferritic heat resistant steels for boiler components**
T Sato, K Tamura & Y Fukuda, Babcock-Hitachi; T Fujita, Tokyo University, Japan
- 3 T/P23, 24, 911 and 92: New grades for advanced coal-fired power plants - properties and experiences**
J C Vaillant & B Vandenberghe, V&M France, France; T Hahn, V&M Germany; H Heuser & C Jochum, Böhler Thyssen Schweisstechnik Deutschland, Germany
- 4 Creep behaviour of a new cast austenitic alloy**
J P Shingledecker, P J Maziasz & N D Evans, Oak Ridge National Laboratory, M J Pollard, Caterpillar Technical Center, USA

Lunch

1240 - 1340 h

SESSION 1 (contd.)**New High Temperature Plant Materials**

- 5 Long-term creep deformation characteristics of advanced ferritic steels for USC power plants**
M Yoshizawa, M Igarashi, Sumitomo Metal Ind., Japan
- 6 Creep rupture behaviour of 3Cr-3W-V bainitic steels**
R L Klueh, N D Evans, P J Maziasz, V K Sikka, Oak Ridge National Laboratory, USA
- 7 Effect of V and Nb contents on mechanical properties of high Cr steel**
T Onizawa, T Wakai, M Ando, K Aoto, Japan Nuclear Cycle Development Institute, Japan
- 8 Improved creep resistance of steel P92 by use of modified heat treatments**
M A Yescas-Gonzales, P F Morris, Corus RD&T, UK
- 9 Influence of normalising heat treatment on precipitation behaviour in modified 9Cr-1Mo steel**
M Yoshino & Y Mishima, Tokyo Institute of Technology, Y Toda, H Kushima, K Sawada & K Kimura, National Institute for Materials Science (NIMS), Japan
- 10 Extrapolation of short-term creep rupture data - the potential risk of over-estimation**
G Dimmler, P Weinert, H Cerjak, Graz University of Technology, Austria

* See papers 11-12 in the **Poster Programme**.

SESSION 2**Physical Damage Measurement**

Coordinator : A Pineau

- 1 Damage evolution during creep of steels**
B Wilshire and H Burt, Materials Research Centre, School of Engineering, University of Wales Swansea, UK
- 2 Dislocation mechanisms controlling the deformation of CMSX-4 single crystals**
H J Penkalla, F Schubert, Jülich Res., Germany
- 3 Time dependent deformation of stand alone plasma sprayed TBCs and related microstructural observations**
R Herzog, E Trunova, R W Steinbrech, E Wessel, R Vassen, F Schubert, L Singheiser, Research Centre Jülich, Germany
- 4 Thermal fatigue damage accumulation in 1CrMoV rotor steel**
S R Holdsworth & J Meier, ALSTOM Power, UK, F Colombo & E Mazza, ETH-Zurich, Switzerland
- 5 Metallographic atlas for 2.25Cr1Mo steels and degradation due to long-term service at the elevated temperatures**
H Kushima, T Watanabe, M Murata, K Kamihira, H Tanaka, K Kimura, National Institute for Materials Science (NIMS), Japan
- 6 Estimation of the failure time for low-carbon CrMoV steels in creep condition using modified kinetic theory based on microstructural parameters**
G Bakic & V Sijacki Zeravcic, University of Belgrade, Serbia, M Radovic, Oak Ridge National Laboratory, USA

Coffee

1540 – 1610 h

SESSION 3**Testing**

Coordinator: R Hurst

1 Multi-scale approach for creep damage of very high temperature reactor (VHTR) materials

W Hoffelner, M Samaras, J Chen & M Pouchon, Paul Scherrer Institut, Switzerland

2 Degradation of Type PR and R thermocouples during long-term creep tests

H Miyazaki & K Kimura, National Institute for Materials Science (NIMS), Japan

3 Some neglected NDE tools

R K Penny, R K Penny and Associates, W Kohlhöfer, Peninsula Technikon, South Africa

4 Modelling the small punch creep test

R W Evans & G C Stratford, University of Wales Swansea, UK

5 Standardisation - a route to enhancing the acceptability of the small punch creep test

R C Hurst, JRC Institute for Energy, The Netherlands, G C Stratford, University of Wales Swansea, UK, V Bicego, CESI, Italy

SESSION 2 (contd.)**Physical Damage Measurement**

7 In search of delayed elasticity prior to fracture in a nickel-base single-crystal, CMSX-10

N K Sinha & R C McKellar, Institute for Aerospace Research, National Research Council, Canada

8 Short term rheology of a polycrystalline nickel-base superalloy involving delayed elasticity

N K Sinha, Institute for Aerospace Research, National Research Council, Canada

9 Elastic properties of heat resistant steels after long-term creep exposure

K Sawada, T Ohmura, T Ohbe, K Tsuzaki, F Abe & K Kimura, National Institute for Materials Science (NIMS), I Nonaka, IHI, Japan

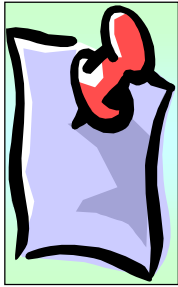
10 The significance of microstructural changes and steam oxidation for the service life of chromium steel components

P J Ennis, Research Centre Jülich, Germany

11 Long-term creep behaviour and microstructural evolution of E911 steel

L Cipolla & A DiGianfrancesco, Centro Sviluppo Materiali, G Cumino & S Caminada, TenarisDalmine; Italy





Poster Paper Presentation

Day 1: 1800 – 1930 hours



Poster papers will be on display during all three days of the conference with a special Poster Presentation organised on the evening of Day 1 when the authors will be formally able to make presentations and discuss their papers with the attendees.

Poster papers will be presented and displayed under their own Sessions (i.e. Session 1, 2 etc.). They will also be published in the Conference Proceedings under their own Session title.

Coordinator: G Wilshire

POSTER SESSION

- 1 Rheological inactivity of AlMgSi conductor alloys in trend of negative stress and temperature gradients**
B Smyrak, T Knych, A Mamala, AGH – University of Science and Technology, Cracow, Poland
- 2 The improvement of creep properties of Fe₃Al type alloys by diverse additives and/or thermal and mechanical treatment**
P Kratochvíl & P Hanus, Technical University in Liberec, J Hakl & T Vlasák, SVUM- Praha, Czech Republic
- 3 Integrity assessment of aged and on-site welded joints in LFMR**
T Wakai, T Onizawa, M Ando, K Aoto, Japan Nuclear Cycle Development Institute, Japan, L Martin, Phenix, France
- 4 Preheating calculation of martensitic creep resistance steel**
Y Elarbi, B Palotas, Budapest University of Technology and Economics, Hungary
- 5 Review of component testing and in-service behaviour comparison**
A Tonti, O Grisolia, ISPESL, Italy, P Auerkari, VTT, Finland - ECCC

SESSION 1: New High Temperature Plant Materials

(remaining papers)

- 11 Long-term creep degradation in 12%Cr ferritic steel tubes and pipes**
*A Iseda, M Yoshizawa, M Igarashi, T Kan, Sumitomo Metal Industries, **Japan***
- 12 Creep rupture data assessments of Alloy 617**
*S Chandra, MAN Turbomaschinen, M Schwienheer, Technische Universität Darmstadt, **Germany**, R Cotgrove, ERA Technology, S R Holdsworth, ALSTOM Power, M Spindler, British Energy Generation, **UK – ECCC***
- 13 *New Paper:* Microstructural study of 617 alloy in various crept conditions**
M Cabibbo^o, E Gariboldi, D Ripamonti*, S Spigarelli^o*
^o Università Politecnica delle Marche, Ancona, Italy
**Politecnico di Milano, Milano, Italy*
-

SESSION 4: Data Analysis

(remaining papers)

- 14 Assessment of Nimonic 80A**
*S R Holdsworth, ALSTOM Power, **UK**, G Merckling, ISB, **Italy – ECCC***
- 15 Creep strain modelling of particle strengthened material**
*H Magnusson, R Sandström, Royal Institute of Technology, **Sweden***
-

SESSION 5: Plant Performance

(remaining papers)

- 10 Non-destructive testing on creep designed components during fabrication and service**
*C Delle Site, A Tonti, ISPESL, **Italy***
-

SESSION 7: Defect Assessment

(remaining papers)

- 6 Low temperature (350-400°C) creep and creep crack growth in C-Mn and low alloy steels and the role of free nitrogen**
*I A Shibli, European Technology Development, **UK***

7 Creep and creep crack growth studies on as received and aged 1Cr1Mo¹/₄V rotor steel for predicting the remaining life

K Singh, G J Reddy, C R Prasad, BHEL, M Kamaraj, IIT Madras, India

8 Assessment of creep crack incubation and growth in a welded ¹/₂Cr¹/₂Mo¹/₄V pressure vessel

R D Patel and D W Dean, British Energy Generation Ltd, UK

SESSION 8: Welds

(remaining papers)

9 The effect of weld bead deposition on the level of residual stresses and properties of low-alloy creep resistant T24 steel weld deposits

L Mraz, P Bernasovsky, P Brziak, P Ziřák, Welding Research Institute, Bratislava, Slovakia; J Robinson, D Tanner, University of Limerick, Ireland

SESSION 9: Remaining Life Assessment

(remaining papers)

10 Effects of high temperature oxidation on creep life prediction of Cr-Mo components

A Al-Mazrouee, R N Ibrahim, R K Singh Raman, Monash University, Australia

11 Creep behaviour of 2.25Cr-1Mo steel - An equivalence between hot tensile and creep testing data

L de Oliveira Bueno, Federal University of São Carlos, Brazil

DAY 2

Tuesday, 13th September 2005

Day 2 Theme: DATA ACQUISITION, ANALYSIS AND APPLICATION

Keynote Paper 3

0900 - 0940

Acquisition of long-term creep data and knowledge for new applications

K Yagi, NIMS, Japan

SESSION 4: Data Analysis

0940 - 1100

Coordinator: M Spindler

1 A comparison of creep models for nickel base alloys for advanced energy systems

R W Swindeman, Oak Ridge National Laboratory, M J Swindeman, University of Dayton Research Institute, USA

2 Causes of overestimation of creep rupture strength in 11Cr-2W-0.3Mo-CuVNb steel

K Maruyama, J S Lee, Tohoku University, Japan

3 Factors influencing creep model equation selection

S R Holdsworth, ALSTOM Power, M Askins, RWE npower, A Baker, British Energy Generation, UK, E Gariboldi, Politecnico di Milano, Italy, S Holmström, VTT, Finland, A Klenk & M Ringel, MPA Stuttgart, Germany, G Merckling, ISB, Italy, R Sandström, KIMAB, Sweden, M Schwienheer, IfW TU Darmstadt, Germany & S Spigarelli, Università Politecnica delle Marche, Italy – ECCC

4 On the edge of reality - an evaluation of parametric representations of creep strain and rupture data

J M Brear, Stress Engineering Services (Europe), UK

Coffee

1100 – 1130 h

PARALLEL SESSIONS

1130 – 1250

SESSION 4 (contd.):

Data Analysis

5 Assessment of creep rupture strength for the new martensitic 9% Cr steels E911 and T/P92

W Bendick, Salzgitter Mannesmann Forschung, Germany, J Gabrel, Vallourec Research Center, France – ECCC

6 Microstructure-based creep modelling of a 9%Cr martensitic steel

H Semba, National Institute for Materials Science, Japan, B Dyson & M McLean, Imperial College, UK

7 Assessing the accuracy of creep life prediction models

M Evans, University of Wales Swansea, UK

8 Effect of short-term data on predicted creep rupture life - pivoting effect and optimized censoring

S Holmström, P Auerkari, VTT Industrial Systems, Finland

SESSION 5:

Plant Performance

Coordinator: P Auerkari

1 Creep strain measurements for risk based monitoring of steam pipes and headers

H J M Hulshof, P G M Welberg, KEMA Nederland, L E de Bruijn, E.ON Benelux Generation, The Netherlands

2 Integrity assessment of the inner casing turbine bolts in Poolbeg Unit 2

J H Bulloch, P J Bernard, ESB, Ireland

3 An approach for optimising inspection plan of tubes operated at elevated temperature with Markov chain model

M Yatomi, A Fuji, Ishikawajima-Harima Heavy Industries, Japan

4 Chemical pipelines material damage conditions

J Okrajni, K Mutwil, M Ciesla, Silesian University of Technology, Poland

Lunch

1250 – 1350 h

SESSION 4 (contd.):**Data Analysis**

- 9 Creep deformation, rupture and ductility of Esshete 1250**
M W Spindler, British Energy, S L Spindler, Stresswork Ltd, UK – ECCC
- 10 A "characteristic strain" model for creep**
J Bolton, Consultant, ALSTOM Power, UK
- 11 Multi-scale modelling of creep in ferritic power plant steels**
Y-F Yin, R G Faulkner, Loughborough University, UK
- 12 Statistically based creep parameters for implicit state-variable subroutines**
P S White, ALSTOM Power Technology Centre, UK
- 13 A unit cell approach to the analysis of the anisotropic creep behaviour of a 9CrMoVNbN weld metal**
T H Hyde, W Sun, University of Nottingham, UK

SESSION 5 (contd.):**Plant Performance**

- 5 Girth weld cracking in high temperature headers**
J Parker, L Bisbee, Structural Integrity Associates, USA
- 6 In service Type IV cracking in a modified 9Cr (grade 91) header**
S J Brett, D L Oates, C Johnston, RWE npower, UK
- 7 Comparative analysis of the creep behaviour in a power plant component using different material models**
E Gorash & G Lvov. Technical University Charkov, Ukraine, J Harder, Aachen University of Applied Sciences, Y Kostenko & K Wieghardt, Siemens, Germany
- 8 The application of damage mechanics concepts to creep data extrapolation and power plant life assessment**
H C Furtado, Centro de Pesquisas de Energia Elétrica (CEPEL), Brazil, I Le May & R Peace, Metallurgical Consulting Services Ltd, Canada
- 9 Creep and creep-fatigue failures of the power units elements after long time operation**
J Trzeszczynski, J Dobosiewicz, Pro Novum Ltd, Poland

* See papers 14 and 15 in the **Poster Programme**.

* See paper 10 in the **Poster Programme**.

Coffee

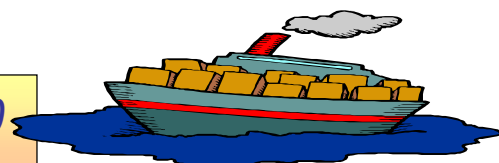
1530 – 1550 h

SESSION 6**Creep-Fatigue***Coordinator: K-H Mayer*

- 1 **Effects of dwell location on the creep fatigue endurance of cast Type 304L**
M W Spindler, British Energy, UK
- 2 **A new scatter band assessment procedure for multi-heat fatigue life data**
C Berger, A Scholz, M Schwienheer, R Znajda, Institute of Materials Technology, Darmstadt University of Technology, Germany
- 3 **Constitutive equations of adapted complexity for high temperature loading**
M Ringel, E Roos, K Maile, A Klenk, Materials Testing Institute (MPA) University of Stuttgart, Germany
- 4 **Experimentally based modelling of cyclically induced softening in a martensitic steel at high temperature**
B Fournier, M Sauzay, M Mottot, H Brillet & I Monnet, CEA, A Pineau, ENSMP, France
- 5 **Mechanical behaviour of single crystal superalloy SC16 under hold time LCF loading**
G Schumacher, Hahn-Meitner-Institut Berlin, W Chen, Institut für Physik, Kristallographie, HU Berlin, Germany

SESSION 7**Defect Assessment***Coordinator: G W Webster*

- 1 **Investigation of creep and creep fatigue crack growth behaviour of P92 in different atmospheres at about 600°C**
L Mikulová, F Schubert, Research Centre Jülich, Germany
- 2 **Crack behaviour of 10-Cr steels under creep and creep-fatigue conditions**
F Mueller, A Scholz, C Berger, IfW TU-Darmstadt, A Klenk, K Maile, E Roos, MPA University of Stuttgart, Germany
- 3 **Use of the ‘HIDA Procedure’ in the structural integrity assessment of weld repairs in high temperature plant**
N Le Mat Hamata, European Technology Development, UK, S Marie, CEA, Saclay, France
- 4 **Steam turbine component integrity analysis based on high temperature fracture mechanics**
A Bagaviev, Siemens Power Generation, Germany
- 5 **High temperature crack initiation and defect assessment of power plant steel weldments**
B Dogan, B Petrovski, U Ceyhan, GKSS Research Centre, Germany

* See papers 6 - 8 in the **Poster Programme**.**Boat Cruise & Conference Dinner 1900 – 2230**

DAY 3

Wednesday, 14th September 2005

Day 3 Theme: COMPONENT DESIGN, EVALUATION AND PERFORMANCE

Keynote Paper 4

0900 - 0940

A perspective on the design of high temperature boiler components

I J Perrin & J D Fishburn, ALSTOM Power, Windsor, USA

SESSION 8: Welds

0940 - 1100

Coordinator: D Allen

- 1 Examination of the life extension of an aged weldment by repair welding**
K Koba & A Kanaya, Kyushu Electric Power Co, M Ozaki, T Tokiyoshi & N Nishimura, Mitsubishi Heavy Ind., Japan

- 2 Modelling high temperature creep flow, damage and fracture behaviour of 9Cr1MoVNb steel weldments**
V Gaffard, J Besson & A-F Gourgues-Lorenzon, Ecole des Mines de Paris, France

- 3 "Fourcrack" - An investigation of the creep performance of advanced high alloy steel welds**
D J Allen, E.On-UK, B Harvey, Mitsui-Babcock, S J Brett, RWE npower, UK

- 4 Creep damage and expected creep life for welded 9-11%Cr steels**
P Auerkari, S Holmström, J Veivo, J Salonen, VTT Industrial Systems, Finland

Coffee

1100 – 1130 h

SESSION 8 (contd):**Welds**

- 5 Determination of weld strength factors for the creep rupture strength of welded joints**
J Schubert, Alstom Power Support, Mannheim; A Klenk, K Maile, Materials Testing Institute (MPA), University of Stuttgart, Germany
- 6 Weld strength reduction and creep fracture in nitrogen alloyed 316 stainless steel weldments**
M D Mathew, S Latha, K Bhanu Sankara Rao, S L Mannan, Indira Gandhi Centre for Atomic Research, India
- 7 Influence of weld joint in 2.25Cr-1Mo steel on long-term creep strength reduction**
T Vlasák, J Hák, SVUM, J Sobotka, VITKOVICE Výzkum, Czech Republic
- 8 Creep and creep damage assessment in P91 welded joints**
K Singh, G J Reddy, D V Vidyasagar, V Thyagarajan BHEL, India

* See paper 9 in the **Poster Programme**.

SESSION 9:**Remaining Life Assessment**

Coordinator: R Viswanathan

- 1 Residual life estimation for long-term used power boiler tubes**
I Nonaka & T Ito, IHI, T Ohba & F Abe, NIMS, Japan
- 2 The development of unified residual life assessment method for high temperature steam piping welding joints for boilers using low Cr alloys**
H Nishida, Chugoku Electric Power Co, Japan
- 3 Life assessment based upon the strain measurement in the tertiary creep regime**
S Fujibayashi, Idemitsu Engineering Co, Japan, N Hide & M Wood, ERA Technology, UK
- 4 Effect of oxidation on creep data: Part 1 – Comparison between some constant load creep results in air and vacuum on 2¼Cr-1Mo steel from 600°C to 700 °C; Part 2 – A procedure for assessing the effect of oxidation on constant stress or constant load creep curves using the Theta-Projection concept**
L de Oliveira Bueno, Federal University of São Carlos, Brazil

SESSION 10**Component Design***Coordinator: G Baylac*

- 1 Creep rupture life and design factors for high strength ferritic steels**
F Masuyama, Kyushu Institute of Technology, Japan
- 2 Stress to produce minimum creep rate of 10^{-5} %/h and stress to cause rupture in 10^5 h for ferritic and austenitic steels and Ni base superalloys**
F Abe, National Institute for Materials Science, Japan
- 3 Review of allowable stress and new guideline of long-term creep strength assessment for high Cr ferritic creep resistant steels**
K Kimura, National Institute for Materials Science (NIMS), Japan
- 4 A new predictive method of stress relaxation behaviour for high temperature structural materials**
G Raghavender Rao, BHEL, Hyderabad; O P Gupta, Indian Institute of Technology, Delhi; B Pradhan, Indian Institute of Technology, Kharagpur, India
- 5 Analysis of structures based on a characteristic strain model of creep**
J Bolton, Consultant, Alstom Power, UK

SESSION 9 (contd.)**Remaining Life Assessment**

- 5 Industrial application of creep/fatigue crack initiation and growth procedures for RLA of steam turbine components**
A Bagaviev, S Sheng, Siemens Power Generation, Germany
- 6 Creep and creep-fatigue life assessment of boiler weldment parts**
T Ogata, M Yaguchi, Central Research Institute of Electric Power Industry, Japan
- 7 A correlation between stress rupture test results and normalized oxide scale thickness for reheater tubes of 210 MW fossil boilers**
V Kumar, Field Engineering Services, Bharat Heavy Electricals Limited (BHEL), India
- 8 Life assessment and creep damage monitoring of high temperature pressure components in South Africa's power plant**
F H van Zyl & G von dem Bongart, Consultants, M E J Bezuidenhout, P Doubell, F C Havinga, D A H Pegler, M Newby, W Smit, Eskom, South Africa
- 9 Remaining life evaluation of high temperature components by X-ray diffraction**
I Marcelles & J Azcue, Tecnatom, V Kolarik, L Rol & H Fietzek, Fraunhofer-ICT, G Calderon & J M Armesto, Endesa, J M Jiminez, Repsol-YPF, V Mentl, Skoda, F Hnilica, UJP-Praha, J J Fiala, West-Bohemian University, T Abbas, CINAR Ltd, Europe

* See papers 10 - 11 in the **Poster Programme**.**CONCLUDING REMARKS****1530 HRS**

