

3-day International Conference

Experience with the manufacture, welding, quality control and use of T/P91-92, T/P23-24 steels

Dates: 20 – 22 April 2016

Venue: Hotel DONGHUSHUYUSN, **Wuhan, China,**

Tian-er-lu 6#, Wuchang, Wuhan (about 100m in the north of Chagang Gate, Wuhan University)

<http://hotel.elong.net/wuhan/90917013/> Tel: +86 27 87276888 Booking: +86 4009 3333 33

Accommodation: Hongyi Hotel (Wuhan University International Academic Communication Center),

136 Donghu Road, Wuchang District, 430071 **Wuhan, China**

www.wdhy-hotel.com Tel: +86 27 67819888 Fax: +86 27 67819988



Provisional Program & Registration Form

Organisers



European Technology Development, UK (www.etd-consulting.com)



Wuhan University, China (www.whu.edu.cn)



MAZUR ENERGY
THE MOST EXPERIENCED IN P91 / P92

Mazur Energy, Poland (www.mazurenergy.pl)



Professional Committee of Metallic Materials, Chinese Society for Electrical Engineering,
Professional Committee for Power Plant Welding, Chinese Society for Electrical Engineering (www.csee.org.cn)



Professional Committee for Materials, Chinese Society for Power Engineering (www.cspe.cpeweb.com.cn)



China Electric Power Technology Net (www.eptchina.cn)

Sponsors & Associates

EPERC - (European Pressure Equipment Research Council) - *Reduced Registration Fee for EPERC members*

Chinese and other industries are invited to sponsor. Please contact: enquiries@etd-consulting.com

Why This Conference?

The pace of change in power and process plant sectors has never been faster with a continuing move from the low alloy materials to higher strength higher alloy materials that can withstand higher temperatures and pressures. All of this is in an effort to increase output, efficiency and flexibility and to reduce pollution and associated penalties. The new high strength materials such as the now ubiquitous high Cr ferritic steels, for example T/P91-92, have another particular benefit in that due to their higher creep strength components can be manufactured in smaller wall thickness thus saving time and costs in manufacturing, welding, transportation, erection etc. The smaller wall thickness also means that the adverse thermal fatigue effect due to power plant cycling will be less. Therefore, the use of the T/P91-92 steels is now becoming a common mode of operation worldwide. However, the 'drawback' can be the relative sensitivity of these steels to heat treatment during steel production and component manufacture. This includes forming/bending or welding and the heat treatment involved, and the resulting micro-structural details. In this situation, new modified low Cr ferritic steels such as T/P23-24 are now increasingly being considered and indeed used in new generation USC power plants as the post-weld/repair heat treatment, which can be difficult to control in an industrial environment, is less critical for these steels. However, a number of research studies have shown that steam-side oxidation resistance of these new low Cr steels may not be as good as that of the high Cr steels. This has implications on the use of thin wall boiler tubing for superheaters made from these high Cr steels.

The other factors that need special consideration are component monitoring and integrity/ life assessment at the mid-life stage for the new high Cr steels. Life assessment, which has been successfully used in the traditional low alloy steels for creep life exhaustion studies, can be particularly problematic as cavitation in the high Cr steels appears late in life, and also some abnormal microstructures produced by forming/ bending or welding and the heat treatment involved as well as operating have already affected component lives of these steels in service. Therefore, new concepts/ technologies/ techniques are required to enable plant operators to reliably predict damage/ failure and to correctly make 'run, repair or replace' decisions.

Unlike most other 'research' conferences this Conference will be aimed at industry. The aim is to bring together industry engineers and researchers from around the world and discuss successful fabrication, demonstration, use and integrity assessment of these steels.

Steel producers, plant manufacturers and users from all over the world are expected to participate in this conference. Therefore, it should be an excellent opportunity for building links with Chinese industry, understanding the issues involved and discussing possibilities for collaboration among companies and researchers worldwide.

Technical Enquiries: Dr. Ahmed Shibli: ashibli@etd-consulting.com Tel: +44 1372363111

Full papers submission deadline (optional) = Monday 29th February 2016

(As this is primarily an industry led conference some industry experts may not be interested in offering full papers. In that case their presentations in PDF format will be published in the electronic version of the Proceedings.) These should be sent to Dr A Shibli at: ashibli@etd-consulting.com

Conference Proceedings: The Conference Proceedings in electronic format will be provided to the attendees within a fortnight of the conference. There is a possibility of publishing a paper version/book as well. Please check the website www.etd-consulting.com regularly for updates. Selected papers will also be published in international journals.

Oral Presentations will be as follows:

- Keynote Papers = 30 minutes (including 3 minutes for discussion)
- Other Papers = 20 minutes (including 2 minutes for discussion)

SIGHTSEEIN IN WUHAN

<http://www.travelchinaguide.com/attraction/hubei/wuhan/>

<http://www.tour-beijing.com/blog/china-travel/china-top-10/top-10-wuhan-attractions-top-10-things-to-do- in-wuhan/>

Who Should Attend The Seminar?

- *Plant managers, operators and maintenance engineers* of the HRSG/power plant using P/T 91 or intending/planning to use this material.
- *Plant manufacturers and alloy producers:* to be aware of the pitfalls and unsatisfactory practices.
- Engineers from *service providing / consulting companies.*
- *Inspection* personnel seeking an appreciation of the problems and damage/ cracking behaviour.
- *Planning* personnel seeking a better understanding and required replacement / repair strategies.
- *Researchers* involved in developing P91 and P92 component integrity, life and crack assessment methodologies who need to know the industry experience and needs.

Sponsorship and Exhibition Opportunities

This international conference is being attended by power plant operators, manufacturers, researchers, steel producers and service providers, particularly from China. Thus it will be a great opportunity for the exhibition of your products/ services. For information and costs involved please contact: enquiries@etd-consulting.com

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 Prof Zhifang Peng, Wuhan University, **China (Conference Chairman)**
 Mr. Henryk Mazur, Mazur Energy, **Poland**
 Dr. David Robertson, ETD Consulting, **UK**
 Prof. F Masuyama, Kyushu Institute of Technology, **Japan**
 Dr Martin Prager, Materials Property Council, New York, **USA**
 Dr Stuart Holdsworth, Empa, **Switzerland**
 Dr N Komai, MHI, Nagasaki, **Japan**

Mr. Staf Huysman, Laborelec/ GDF Suez, **Belgium**
 Dr. Zhuyao Zhang, Metrode Products Ltd, **UK**
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 Zhiwu Wang, Wuhan University
 Qingsong Mei, Wuhan University

Wenkai Xiao, Wuhan University
 Yiyin Shan, Institute of Metal Research, Chinese Academy of Sciences
 Jun Guo, China Electric Power Research Institute
 Jianmin Jia, Xi'an Thermal Power Research Institute Co., Ltd.
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 Shutao Liu, Xi'an Thermal Power Research Institute Co., Ltd.
 Zuogui Zhang, Shanghai Power Equipment Research Institute
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 Huichuan Zhao, China Shenhua Energy Company Limited Guohua Power Branch
 Hongguo Liu, Shenhua Fujian Energy Co., Ltd.
 Jun Liang, Shenhua Guohua (Beijing) Electric Power Research Institute Co., Ltd.
 Baolin Liu, China Datang Corporation Science and Technology Research Institute Co., Ltd.
 Yalin Zhang, State Grid Guodian Science and Technology Research Institute Wuhan Branch

About the Organisers

European Technology Development (ETD)

ETD Consulting is a UK based engineering advisory, consulting and R&D company specialising in high temperature plant life assessment/extension, maintenance, materials and engineering issues in all type of power generating and petrochemical/process plant. Consulting is the core business of ETD.

ETD has been organising for nearly two decades various international workshops/ courses/ conferences in Europe, USA and Asia mainly on the issues such as: industrial plant life assessment/extension, high temperature plant materials, plant component safety and durability, performance of in-service welds, power plant cycling, risk based maintenance (RBM), probabilistic assessment, weld repairs etc. The company has been leading and co-ordinating a number of large leading edge international industry initiatives (supported by the industry from North America, Japan, Europe and elsewhere or by government organisations such as the European Commission) on issues related to the assessment and improvement of high temperature plant performance, materials and design, maintenance and inspection strategies.

Further information about ETD, its projects, life assessment courses offered and other activities can be seen at: www.etc-consulting.com

In the past ETD has organized a number of **conferences, seminars and Training Courses** in London, Germany, Portugal, France, USA, Japan, Middle East, Africa and South East Asia on **P91, P92, P23 and P24 issues**. ETD has furthermore published a number of guidelines and review reports on these issues for its international industry sponsors.

Wuhan University (WHU)

Founded in 1893, WHU is a comprehensive and key national university in China. In 2014, WHU was nationally ranked #5 overall, and internationally among 400 renowned universities by US News & World Report, QS, and Times Higher Education, respectively. Located on the shore areas of the East Lake and in/around the Luojia Hills with picturesque views, WHU is honoured as the "Most Beautiful University in China".

The power plant metallic materials and welding undergraduate programs were respectively initiated in 1978 and 1987 at the former Wuhan University of Hydraulic and Electrical Engineering (WUHEE), which was ranked No.1 in the educational system under the former Ministry of Electrical Power Industry of China, and WUHEE had merged with Wuhan University (WUH) in 2000. For decades, both the undergraduate and the postgraduate programs of the Department of Materials Engineering at WUHEE / WHU have been dealing with a relatively larger portion of the course teaching and the laboratory / industrial practice on manufacturing, welding and heat treatment principles and technologies, and basic knowledge on structure and property relationships of power plant steels and alloys. Each year, tens of undergraduate and postgraduate students complete their studies with academic degree(s) and get into the society, mostly into thermo-power industry. Most of them are highly specialized in the related industrial areas.

The research interests of the faculty members in the Department of Materials Engineering at WUHEE / WHU have been dealing with many aspects, but the main research focus is on understanding the inter-relationships between processing, microstructure and properties in advanced metallic materials and the utilization of the knowledge to high temperature metallic materials for use in engineering applications. Central to the research are investigations on HT/RT mechanical properties and cracking behaviours of heat-resistant steels (e.g. **T/P91, T/P92, T/P23, Super304H, TP347H/HFG, HR3C, VM12 and Sanicro 25** etc.) and superalloys (e.g. Inconel alloy **740H, Nimonic alloy C263, Alloy 617B, Inconel alloy 718, CMSX-2, CMSX-4, CMSX-6, PWA1483 and PWA1484**, etc.), with an emphasis on developing both microstructural and phenomenological understanding of creep and fracture processes, and variations in strength, hardness, plasticity and toughness, etc. ***This has promoted related research and corresponding improvement on the methodology and technology for manufacture, welding, quality control, use and life assessment of the high temperature components in industry. The achievements made have benefited both the university and the related industries through a wide range of collaboration.***

Mazur Energy

Mazur Energy Sp. z o.o. – the most experienced in P91 / P92 produces materials from carefully selected steel plants from Asia or Europe (One step delivery). ME organizes in mills complete production of pipes as complete packages for applications within power generation industry, along the refining and oil - gas industry, starting with agreement of client's technical specification, production planning and ITP preparing, through inspection of manufacturing process and quality control, hard marking and ending on final inspection issued with certificate MTC 3.1 or MTC 3.2 with Mazur Energy logo as the producer.

Mazur Energy's turn-key services include **production of steel materials, engineering, fabrication, project management, heavy logistic and consultancy** for every new project or modernization. ME are distinguished by **high level of quality inspection**, unheard in competition, covering many additional and important measurements not included in standards (as an additional hardness and WT measurements every meter of pipe/tube, personal supervising of each part of production from the billets checking to the final product, etc.) **taking full responsibility for final product as a producer**. We specialize in steel materials production especially in P91, P92 for Power Generation, Oil&Gas sector in EN, ASME, API Standard and others working in high temperatures like: pipelines, boiler components, elbows, Y and T fittings, flanges and forges in any size.

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RELATED INTERNATIONAL INDUSTRY PROJECTS

(new partners welcome to join)

ETD Consulting's two recently started Joint Industry or Group Sponsored Projects (GSPs) dealing with P91 and P92 issues include:

- 1) **'P91-P92 Inspection and Life Assessment'** – This 3- year duration industry sponsored project started in April 2014 and is aimed at the further development and demonstration of innovative inspection and life assessment techniques and methodologies, especially for P91 and P92 early stage damage detection. It involves testing of large welded pipes and standard laboratory specimens, test pipe monitoring and periodic shut down for detailed inspection. The damage is then related to remaining life for the development of new life assessment methodologies for P91 and P92.

Existing partners include: (ETD-UK, MPA-Germany, TNB-Malaysia, ENEL-Italy, Electrabel/Laborelec-Belgium, Nippon Steel and Sumitomo Metal Company-Japan). ***New partners are welcome to join.***

- 2) **'Abnormal P91'** – This 5.5-year duration industry sponsored project started in April 2014. It is aimed at generating long term creep/ stress rupture data and estimating safe operating life of P91 welded components containing 'aberrant' P91 base or/and weld metals – the type often found in power plants and showing the risk of early stage damage and failure.

Existing partners include: Engie/GDF Suez (UK/France)/ Electrabel (Belgium) and a Group of Japanese utilities. ***New partners are welcome to join.***

In the area of P91, ETD has also launched a proposal for a new Group Sponsored Project (GSP) called 'WELDLIFE' and is putting together partners for this. The project is expected to start in mid-2016.

WELDLIFE

"Type IV" in-service creep cracking at weld heat-affected zones in leading power plant steels, such as P91 and P92, has often been considered to be a costly but unavoidable life-limiting problem. However, recent Japanese research studies and UK preliminary industrial and collaborative research projects indicate that by: a) improving the heat treatment, and, b) altering the welding processes, Type IV cracking can be slowed down or prevented altogether and thus life of welded components can be improved by a factor 2 to 3. This should result in tremendous benefits for steel producers, plant manufacturers, plant operators and welding companies alike. However, the preliminary findings, exciting as they are, need to be proven in practical application and demonstrated through model component testing, long term stress rupture/ creep test data generation, and detailed analyses for long term safe life prediction and assessment.

This new 5-year duration project is aimed at starting in summer 2016.

Further information on these projects please contact:

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Registration

Wednesday 20th April = 0800 to 0850 h

DAY 1 - WEDNESDAY - 20 April 2016

0850 – 0900 Welcome & Introduction by Conference Chairmen

Prof S Liu, Wuhan University

Dr A Shibli, ETD, UK

Session 1: New Steels, Production and Quality Checks

0900-0930h

Keynote: Introduction to new CSEF 'Miracle' steel P93

*Fujimitsu Masuyama, Graduate School of Engineering, Kyushu Institute of Technology, **Japan***

0930-0950h

The softening mechanism and process control of P91 steel used for steam pipe

Wenhe Cai, Weidong Zhao, Zhichun Wang, Weili Li and Jianping Liu, North China Electric Power

*Research Institute Co., Ltd, Beijing, **China***

0950-1010h

Research on smelting process of high purity P91/P92 Steel

*Yongping Hu, Yadong Xu, Inner Mongolia North Heavy Industries Group Corp. Ltd., Baotou, **China***

1010-1030 h

P91 and P92 material quality check and assurance from mill production through fabrication to plant erection

*Henryk Mazur, Jerzy Pasternak, Mazur Energy, **Poland***

Break 1030 – 1100 h

Session 2: Microstructure & Characterisation

1100-1130h

Keynote: The effects of abnormal microstructures on hardness/ creep rupture life of 9Cr steels
 Zhifang Peng, School of Power and Mechanical Engineering, Wuhan University, Wuhan, China

1130-1150h

Characterisation of P91 steel in the virgin, service exposed and post-service re-normalised conditions
 Huijun Li, Faculty of Engineering, University of Wollongong, Australia

1150-1210h

Localization of P91 / P92 large diameter thick wall seamless steel pipe
 Wenliang Li, Hebei Hongrun Nuclear Equipment Science and Technology Co., Ltd., Hebei, China

1210-1230h

Creep damage evaluation of high Cr ferritic steels based on change in hydrogen thermal desorption characteristic

Shin-ichi Komazaki, Kagoshima University, Japan

1230-1250h

Test methods for determining grain size of P91/P92 Steel
 Xuexing Zhang, Shiyong Mao, Hui Zeng and Wen Yang, Dongfang Boiler Group Co., Ltd., Dongfang Electric Corporation, Zigong, China

Lunch Break

1250 – 1400h

Session 3: Welding Issues

1400-1430h

Keynote: Investigations on weld performance of P92 and T24 steels
 Andreas Klenk, Jürgen Böse, Patrick Buhl, Alexander Hobt, MPA Stuttgart, Germany

1430-1450h

Consumables and weld metal properties of advanced boron-cobalt alloyed 9%Cr-Mo creep resistant steels

Zhuyao Zhang, Metrode Products Ltd., Chertsey, UK

1450-1510h

Hot cracking and its characteristics of SMAW weld metal of T/P92 steel
 Zhongbing Chen, Yishi Lü, Suzhou Nuclear Power Research Institute, Suzhou
 Jiang Xie, Huasheng Wu and Zhiqiang Hou, Guangdong Huizhou Pinghai Power Plant Co. Ltd., Huizhou
 Dehui Cao, Jinhui Yang, Guangdong Power Engineering Corp., Guangzhou, China

1510-1530h

Plant experience with P91 thick section components –Type IV Failures
 Ahmed Shibli, European Technology Development, Leatherhead, Surrey, UK

Break 1530 – 1600 h

Session 4: Aberrant/ Abnormal Microstructures & Chemical Composition Effect

1600-1630h

Keynote: Aberrant P91 and development of inspection and life assessment technologies and methodologies
Ahmed Shibli, European Technology Development, Leatherhead, Surrey, UK

1630-1650 h

Experience with aberrant P91 in Australian power plants
Damien Charman, ALS, Australia

1650-1710h

Code covering and specification tweaking of new boiler steels
Fujimitsu Masuyama and Tomiko Yamaguchi, Graduate School of Engineering, Kyushu Institute of Technology, Japan

1710-1730h

Effect of silicon contents on the microstructures and mechanical properties of heat affected zones for 9 wt.% heat resistance steels
Jian Wang, Shanping Lu, Lijian Rong and Dianzhong Li, Institute of Metal Research, Chinese Academy of Science, Shenyang, China

1730-1800h

Keynote: Influence of chemical compositions on the long-term creep rupture strength of Gr.91 weldments
Nobuyoshi Komai, Mitsubishi Heavy Industries, Ltd., Japan

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RECEPTION & POSTER PAPER SESSION 1800-1900 h

DAY 2 - THURSDAY - 21 April 2016

Session 5: P91 Issues for Plant Manufacturers and Research

0800 – 0830h

Keynote: Material problems of USC boilers and role of National Center for Materials Service Safety (NCMS)

Koichi Yagi, Meiling Wang and Yonghao Lu, National Center for Materials Service Safety (NCMS), University of Science & Technology, Beijing, China

0830 – 0850 h

International P91 Users Group and some of its finding re P91 experience

David Robertson, European Technology Development, Leatherhead, Surrey, UK

0850- 0910h

Providing assembled Grade 91 small diam. piping: risk mitigation the practical point of view of an HRSG supplier

Pascal Fontaine, CMI, Belgium

0910-0930 h

Effect of manufacturing practice on creep properties of Grade 91

Gang Zhou, Joshua Burgess and Dusti Jones, GE Power, USA

Break 0930 – 1000 h

Session 6: P92 and P91 Issues

1000-1030h

Keynote: High temperature fracture parameters representation and time dependent failure assessment diagram construction for P92 steel welded joint under creep-fatigue interaction

*Guodong Zhang, Yanfen Zhao and Lu Zhang, Suzhou Nuclear Power Research Institute, Suzhou
Changyu Zhou, Yi Liu, School of Mechanical and Power Engineering, Nanjing University of Technology, Nanjing*

Tianzuo Liu, Center of technology service, Huadian Power International Corporation Limited, Jinan, China

1030-1050h

Cyclic deformation and damage evaluation for P92 steel under stress controlled creep-fatigue loadings

Peng Zhao, Fuzhen Xuan, School of Mechanical and Power Engineering, East China University of Science and Technology, Shanghai, China

1050-1110h

Performance optimization of the seamless steel P92 used in the ultra supercritical units

Duo Wang, Pengzhan Wang, Yangzhou Lontrin Steel Tube Co., Ltd., Yangzhou, China

1110-1130h

An approach to HBHLDBrinell hardness value converted from Leeb hardness) correction during T/P91 steel pipe detection

*Chao Yang, Jiangsu Frontier Electric Technology Co., Ltd., Nanjing
Chunpo Tang, Guodian Taizhou Power Generation Co., Ltd., Taizhou, China*

1130-1200h

Keynote: Completely refined excellent heavy wall Gr.91 steel plate as class 2 in ASME code and the long term stable creep strength of Gr.92 steel for mass products

Y Hasegawa, Nippon Steel and Sumitomo Metal Co., Japan

Lunch Break	1200 – 1300 h
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Session 7: P91 Piping Issues

1300-1330h

Keynote: Innovative method of reinforcing damaged high temperature P91 steam piping

Hidetaka Nishida, Chugoku Electric Power Co, Higashi-Hiroshima, Japan

1330-1350h

Quality problems and control of the four main pipes in ultra supercritical thermal power units during pipe-processing

Xiao Tian, Baixun Yang, Zhongyu Ma, Yimin Li, Hui Xu and Xiaoxuan Tian, Xi'an Thermal Power Research Institute Co., Ltd., Xi'an, China

1350-1420h

Cracking analysis of a P91 reheating elbow after long-term service

Wensheng Li, Wei Wang and Wanli Zhong, Electric Power Research Institute of Guangdong Power Grid Corporation, Guangzhou

Xu Yang, Yiyin Shan, Institute of Metal Research, Chinese Academy of Sciences, Shenyang

Xu Yang, State Key Laboratory of Metastable Materials Science and Technology, Yanshan University, Qinhuangdao, China

1420-1440h

How to achieve optimum physical properties of Grade 91 creep resistant steel

Muhammad Turi, Axis Metallurgical Services Co., Saudi Arabia

Mohammad Haris, Arabian Bemco Contracting Co., Saudi Arabia

1440-1500h

Study on the change law of T91 steel's microstructure during aging at 750°C

Zhiwu Wang, Jing Tian and Tao Song, School of Power and Mechanical Engineering, Wuhan University, Wuhan, China

Break 1500 – 1530h

Session 8: Numerical/ Testing, T23 Steel

1530-1600h

Keynote: The design of phenomenological law for minimum creep rate and stress for high Cr alloys

Qiang Xu, Huddersfield University, UK

1600-1630h

Keynote: Influence on microstructure and high temperature mechanical properties of T23 boiler tube with different service time

Cheng He, Wensheng Li, Jianping Zhao, Hong Ai, Yang Liu, State Grid Xinjiang Electric Power Research Institute, Wulumuqi

Kai Xu, Xinjiang Electric Power Construction and Commission Institute, Wulumuqi

Baoliang Shi, Ai Ren, Yan Li, Likui Weng and Tengfei Zhang, Shenzhen Guoneng Hechuang Energy Technology Institute, Shenzhen, China

1630-1650h

Analysis on short-term failure of T23 steel welded joints in water wall of USC tower boilers

Xue Wang, Lei Hu, School of Power and Mechanical Engineering, Wuhan University, Wuhan

Xiqiang Li, Chao Yang, Zhaoxiang Ge and Qingxu Yang, Jiangsu Frontier Electric Technology Co., Ltd., Nanjing, China

1650-1710h

T23 (CC2199) material and manufacturing

Yutao Hu, Dayong Zhang, Wuhan Boiler Co., Ltd., Wuhan, China

1710-1730h

Nondestructive method applying phased array for testing stacking oxide skin on inner surface of heat-receiving-side steel tube in power plants

Baolin Liu, Ning Zhou, Xingxin Sun, Jianwei Zhang, Jing Chen and Mengyang Li, China Datang Corporation Science and Technology Research Institute Co., Ltd, Xi'an, China

1750-1810h

Assessment of temperature dependency of creep properties and creep life assessment for T91 steel by using small punch creep test

Nguyen Thanh Tuan, Nguyen Manh Hung, Young Wha Ma and Kee Bong Yoon, Department of Mechanical Engineering, Chung Ang University, Seoul, Korea

CONFERENCE DINNER 1900 - 2200h

DAY 3 - FRIDAY - 22 April 2016

Session 9: T91 Tubular Components, Corrosion Issues

0800-0830 h

Keynote: 11. Life management of T91 boiler tubes

S Kihara, Best Materia Co., Tokyo, Japan

0830-0850h

Effect of creep temperature on microstructure of T91 heat resistant steel

Qijiang Wang, Baoshan Iron & Steel Co., Ltd., Shanghai, China

0850-0910h

Degeneration analysis and life assessment of reheater tube in a 350MW unit after long time service

Zuogui Zhang, Haibo Wan, Rui Fu, Yanfeng Wang and Fusheng Lin, Shanghai Power Equipment Research Institute, Shanghai, China

0910-0930h

Research on the feasibility of using 9Cr-3W-3Co as water wall of 700°C USC boilers

Yufeng Zhu, Yu Wang, Chongbin Wang, Xiaoli Lu, Yongqiang Jin and Jianyong Wang, Shanghai Boiler Works, Ltd., Shanghai, China

0930-0950h

The corrosion behavior of P91 and P92 in supercritical water containing dissolved oxygen

Hong Xu, School of Energy, Power and Mechanical Engineering, North China Electric Power University, Beijing, China

0950-1010h

Corrosion and stress corrosion cracking of ferritic / martensitic steels in supercritical water

Naiqiang Zhang, School of Energy Power and Mechanical Engineering, North China Electric Power University, Beijing, China

Break 1010– 1040h

Session 10: Dissimilar Welds, Creep/Fatigue Cracking

1040-1110h

Keynote: Characterization of Grade 91 dissimilar metal weldments

Joshua Burgess, Gang Zhou and Dusti Jones, GE Power, USA

1110-1130h

Welding of P91 steel with Russian 12X1MF steel at a superheater pipeline

Alexandros Antonatos, Test Research and Standards Center of Public Power Corporation of Greece, Greece

1130-1150h

The creep failure behavior of dissimilar welded joint between T91 and HR3C

*Jianqiang Zhang, Jialin Guo, School of Power and Mechanical Engineering, Wuhan University, Wuhan
Bingyin Yao, Taijiang Li and Fuguang Liu, Xi'an Thermal Power Research Institute Co., Ltd, Xi'an, China*

1150-1220h

Keynote: Creep-fatigue crack growth behavior of 9Cr Steel

Kee Bong Yoon¹, Seung Youn Han¹ and Young Wha Ma²

¹ Professor and Graduate Student (respectively), Chung Ang University, Seoul, Korea

²Lead Research Engineer, Corporate R&D Institute, Doosan Heavy Industries & Construction, Gyeongnam, Korea

Lunch Break	1220 – 1310h
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Session 11: P91 Steel Production, Life Assessment

1310-1340h

Keynote: Rolling technology research of heavy caliber ($\geq\Phi 700\text{mm}$) thick wall P91 seamless steel pipes for ultra-supercritical unit

Wen Huang, Wuhan Heavy Industry Casting & Forging Co., Ltd., Wuhan, China

1340-1400h

P91 pipe billet crack reason analysis and microstructure recognition

Lixin Zhou, Hubei Xinyegang Steel Co., Ltd., Huangshi, China

1400-1420h

Development of residual life diagnosis method by strain for 9% Cr steel welded steam piping

Hidetaka Nishida, Chugoku Electric Power Co, Higashi-Hiroshima, Japan

1420-1440h

Investigation on aging properties of P91 steel in ultra-supercritical power units

Peng Duan, Shufeng He, Yuzhe Liu and Guoping Qiu, Song Wang, Shanghai Minghua Electric Power Technology Engineering Co., Ltd., Shanghai, China

1440-1500h

The remaining life expectancy estimation of P91 pipe base on the calculation of precipitate sizes

Hai Wang, Xu Yang, Wei Yan, Yiyin Shan and Ke Yang, Institute of Metal Research, Chinese Academy of Sciences, Shenyang, China

1500-1520h

The new power law creep equation and its application in predicting the long term creep rupture strength of creep resistant steels

Zhidong Xiang, School of Materials and Metallurgy, Wuhan University of Science and Technology, Wuhan, China

1520-1540h

Numerical simulation in resistance spot welding of ultra-high strength hot-formed steel and the low carbon steel

Chao Feng, Bicao Peng, Wenbo Li, Jun Wang and Yi Long, Hunan Electric Power Corporation Research Institute, Changsha, China

1540-1600h

Safety performance assessment strategies of T/P91 steel based on Leeb hardness

Dengke Li, Guosheng Xie, Huiguo Long and Yi Xie, Hunan Electric Power Corporation Research Institute, Changsha, China

1600-1620h

Analysis on anelastic recovery in the creep-fatigue interaction of P92 at high temperature

Shanglin Zhang, Fuzhen Xuan, Sujuan Guo and Peng Zhao, School of Mechanical and Power Engineering, East China University of Science and Technology, Shanghai, China

1620-1640h

The Creep Life Prediction of Service-exposed Materials Based on The Change of High Temperature Yield Strength

Haibo Wan, Zuogui Zhang, Shanghai Power Equipment Research Institute, Shanghai, China

PANEL DISCUSSION & CLOSING REMARKS 1640 – 1700h

POSTER PAPERS

Poster Paper 1

Effect of heat exposure treatment on the microstructure and mechanical properties of 12Cr1MoV Steel

Kaidi Cheng, Jin Shi, Weize Wang, Zhengqu Feng, Chengzhou Chen, School of Mechanical and Power Engineering, East China University of Science and Technology, Shanghai, China

Poster Paper 2

Scanning Force Microscopy for P91/ P92 early stage damage detection

A Shibli, D Robertson, European Technology Development, Leatherhead, Surrey, UK

Poster Paper 3

Research on detection of accumulated oxide at the bends of austenitic stainless steel tube by electromagnetic method

Guosheng Xie, Huiguo Long, Yi Long, Dengke Li

Hunan Xiangdian Boiler & Pressure Vessel Test Center Ltd., Changsha, China

State Grid Hunan Electric Power Company Research Institute, Changsha, China

Poster Paper 4

Recent development of microstructural analyses by means of Oxford Instruments

Andy Xu and Bernard Li, Oxford Instruments (Shanghai), Co., Ltd. China, Zhifang Peng, Sheng Liu, Zhenbin Shi and WenRen, Wuhan University, China

Poster Paper 5

The creep life prediction of service-exposed materials based on the change of high temperature yield strength

Haibo Wan, Zuogui Zhang, Shanghai Power Equipment Research Institute, Shanghai, China

REGISTRATION FORM*(Please copy and e-mail / fax / post)***T/P 91-92, 23-24 Conference** - 20-22 April 2016**Venue:** Wuhan University, China

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	Reduced Fee (US dollars) (if paying by 14 th March 2016)	Full Fee (US dollars) (from 15 th March 2016)
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* **Notes:** 1) 10% reduction in fee for the 2nd, 3rd, 4th ... attendees from the same organisation.

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