

## 2-Days Training Course aimed at **Industry**




### **P92 & P91 FABRICATION, WELDING, HEAT TREATMENT, OXIDATION, DAMAGE MECHANISMS & INTEGRITY/LIFE ASSESSMENT**



**Note:** P92/P91 course will be followed by optional **2-days Int. Conference** (4-5 August) to discuss the Use of New Materials (**9-12Cr, P23, P24, Stainless Steels & Ni-based Alloys**) in the current and future generation of USC power plants. To see programme details please visit: [www.etc1.co.uk](http://www.etc1.co.uk)



**Venue & Accommodation:**   
The Blackstone Renaissance Hotel, Chicago, IL  
*\* (please follow the link below for room reservation)*

**2-Day Training Course**

**Dates:** 2 - 3 August 2011

European Technology Development (UK) are pleased to announce the organisation of this 2-day *Training Course* covering: a) the affect of welding, heat treatment, pipe/tube manufacture/bending on the material microstructure and its short to long term properties, and, b) the principles of oxidation, specially steam side oxidation, oxide spalling and the damage thus caused to plant. It will further cover in detail **life assessment** issues faced by the plant operators and other aspects such as weld repairs, sources of materials data, Type IV cracking, the effect of chemical composition and other related issues.

After having conducted P91 courses for the last few years, ETD are now including P92 in this course as this steel is now becoming of equal interest to industry worldwide.

*Speakers will be imminent workers in this field with successful industry & research experience.*

\* Accommodation at a reduced rate of \$160/day is available for booking until 5 pm, Monday 11<sup>th</sup> July 2011. To make a room reservation please click on the link below. You will then be directed to the hotel's home page with the negotiated rate code already entered in the appropriate field.

[Renaissance Blackstone Chicago Hotel >>](#)

Phone: + 1312 4470955

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## WHY THIS COURSE ?

Recently there has been a concern in high temperature industry following a number of failures in **9Cr martensitic steel thick section components** (at plant operating life of as short as 20,000 hours) and in **dissimilar metal welds** (at plant life of only 5,000 hours in some cases). In the case of **thin section components** recent findings from research and demonstration projects (supported by limited plant experience) have shown that the **steam side performance** of T91 or T92 tubes is not as good as originally predicted with reports of replacement by some utilities of T91 superheater tubing after only a short service duration of a few years. Furthermore, recent work and publications by plant manufacturers, operators and researchers have shown that, unlike the traditional CrMoV steels, the **heat treatment** of these steels both during and after component and weld production needs to be precise as its control and management can be critical in determining the integrity of P/T91 components. Successful plant operators have relied on detailed material understanding and component **quality checks** to ensure safe and reliable operation of their plant. Similarly for **welding** the more successful plant manufacturers have relied on high quality welding and have followed more promising procedures. However, unfortunately there is no international consensus on the best procedures to use. Some international procedures/ recommend practices have now been found not to be suitable for these steels but will continue to be followed or various reasons. Partly as a result of this, there is now new steel in the market, and old one in service, that needs more careful analysis, **NDE, hardness checks, component monitoring and integrity assessment**.

Moreover, in the new competitive market outsourcing has become a common practice by the manufacturers in an effort to cut the price of new plant. But some times outsourcing of plant manufacturing and welding to companies with relatively less experience and unsatisfactory practices has caused, and continues to cause, problems with new plants using this material. In the case of **HRSGs** this can have even more far reaching effects due to their compact nature and thus the difficulty of access to many components for monitoring or repair. Thus the plant manufacturers, owners, operators, service providers and inspection/ insurance/ safety authorities all need to be aware of the complexities of the issues involved and how to recognise problems when they occur in components made from this steel e.g. vulnerable casts, incorrect heat treatment etc. both at the purchase and at the plant operation stages.

*The understanding of the basic mechanisms and characteristics of these steels will enable the plant operators and service providers to help operate plant more efficiently and reduce forced outage periods and associated costs/ risks. It will help them to better develop component monitoring strategies, take palliative measures in time and make informed run/ repair/ replacement decisions.*

At the plant component mid-life stage, when a few of the P/T91 components have already shown problems/ cracking/ failures, and P/T92 steel components are expected to do the same, a basic understanding of the underlying principles of the behaviour of these materials will help to develop **cost effective procedures for damage assessment and life prediction** and an understanding of how life of older plant/ structures can be extended.

## Course Presenters

These are experienced practitioners of *international repute* who work for industry and have a well-established track record in the understanding/ study/ practice of P91 production, heat treatment, component assessment and life management in HRSG/power generation and petrochemical industries.

## Who Should Attend?

If you have responsibility for, or you are involved with, any of the following functions in Power Generation or Petrochemical industries.

- Engineering
- Maintenance
- Inspection - assessment of defect significance
- Insurance
- Service provision
- Planning
- Component monitoring
- P/T91 similar and dissimilar metal welding and the weld assessment
- Research and Development
- Material procurement and quality assurance
- All those involved in integrity / life assessment of P/T91 components

### Technical Enquiries to:

Dr David Robertson Tel: + 441372 363 112 [drobotson@etd1.co.uk](mailto:drobotson@etd1.co.uk)

## Who Are We ?

**European Technology Development Ltd. (ETD)** 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 process plant. ETD has, in the recent past, organised various international workshops/ courses/ conferences in the UK, a number of other European countries (Germany, France, Portugal etc.) and Asia, mainly on the issues such as: plant life assessment/extension, high temperature plant materials, plant component safety and durability, performance of in-service welds, power plant cycling and power plant risk based maintenance (RBM). The company is 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 funding agencies such as the European Commission) on issues related to the assessment and improvement of high temperature plant performance, materials and design, and maintenance and inspection strategies. The company has carried out/ participated in some leading edge projects on P91 weld repairs, crack assessment, integrity issues and has carried out reviews of P/T91 and P/T92 performance in plant worldwide.

**Further information about ETD**, its projects [e.g. *Review of Experience with New Steels (P91/T91, P92, T23, T24, P122) and Preparation of Guidelines for Assessment*], consultancy services, plant integrity/ life assessment services offered and other activities can be seen at: [www.etd1.co.uk](http://www.etd1.co.uk)

## DAY - 1

### Understanding Material Properties, Microstructure, Heat Treatment and Steam Oxidation

**BREAKFAST & REGISTRATION** 0800 – 0900 hrs

#### Module 1: Material Properties and Heat Treatment

0900 – 1230 h (with 30 minutes break)

#### **Presenter**

*Dr A Shibli, ETD, UK*

#### **Objective**

To develop a better understanding of the underlying concepts and basis of P91 and P92 development, its properties, the effect of heat treatment, chemical composition and understanding its weldment behaviour.

#### **Specific topics will include:**

- P91/P92 specifications, inspections and control required during manufacturing and erection processes.
- Availability of material from various sources and quality control and checks required when purchasing and receiving material. Acceptance test of components, hardness, microstructure etc.
- The effect of heat treatment (autenitising/normalising and tempering) on microstructure and hardness and best available practices.
- The effect of heat treatment on material strength, creep strength, hardness and ductility etc.
- The effect of chemical composition details and what to look for.
- European, ASME and other codes, practices, recommendations, standards and their differences.
- Potential sources of materials data.

LUNCH 1230 – 1330 HOURS

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## **Module 2: Steam-Side Oxidation of Thin Wall Tubing**

*1330-1730 hrs (with 30 minutes break)*

### ***Presenter***

*Prof Dr F Masuyama*

*Ex-Chief Researcher, Mitsubishi Heavy Industries*

*Now with: Kyushu Institute of Technology*

*Dept. Applied Science for Integrated System Engineering, Kitakyushu, Japan*

### ***Objective***

To create a better understanding of the basic principles of oxidation in steam and its effect on tube over-heating and cracking/ failure.

### ***Specific topics will include:***

- Basic principles of P/T91 and P/T92 oxidation, research.
- T91/T92 tubing demonstration and plant failure experience due to steam side oxidation.
- The effect of steam side oxidation on tube metal temperature for T91/T92 tubing and its consequences.
- Effect of plant cycling on oxide spallation.
- Comparison of behaviour with traditional low alloy CrMoV steels.
- Damage effect of T91/T92 spalled oxide on other plant components.
- Repair and replacement of failed tubes and issues involved.

## Day - 2

### Fabrication, welding, Component Integrity and Life Assessment Issues

**BREAKFAST**

*0800 – 0900 hrs*

#### **Module 3: Welding and Welded Component Behaviour**

*0900 – 1200 h (with 30 minutes break)*

##### ***Presenter***

*Dr D Robertson, ETD, UK*

##### **Objective**

To create an understanding of the welding and pre- and post-weld heat treatment requirements and the criticality of the precise control required for this steel. These issues will refer to industrial experience to date.

##### **Specific topics will include:**

- Suitable welding procedures
- Pre-and post-weld heat treatment and Type IV failures in thick section components.
- Strength/ life reduction factors.
- Effect of plant cycling on cracking type, especially Type IV cracking.
- Weld repair issues.
- Dissimilar metal weld issues (P91/P92 to low CrMoV steel welding, P91/P92 to austenitic stainless steel welding), the effect of cycling and lessons from plant experience.

LUNCH

1200 – 1300 HOURS

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## **Module 4: P91/P92 Component Integrity/Life Assessment**

*1300 – 1630 hrs (with 30 minutes break)*

### ***Presenter***

*Prof Dr F Masuyama*

*Ex-Mitsubishi Heavy Industries*

*Now with: Kyushu Institute of Technology*

*Dept. Applied Science for Integrated System Engineering, Kitakyushu, **Japan***

### ***Objectives***

To understand how P/T91 and P/T92 component integrity can be assessed. What are the available techniques and the advantages that they may offer. This includes a better understanding of the basic principles of oxidation in steam and its effect on tube over-heating and cracking/ failure.

### ***Specific topics will include:***

- Late cavitation development due to creep.
- Ductility and hardness issue.
- Type IV failures and their early detection.
- NDE techniques and their use for life assessment.
- Potential of the use of new NDE type techniques.
- Developments in Europe and Japan for P91 and P92 component integrity / life assessment.

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The END



# REGISTRATION FORM

*(Please copy and e-mail / fax / post)*

**P91/P92 Course + New Materials Conference**  
*Chicago, USA, 2 - 5 August 2011*

## REGISTRATION FEE:

➔ Please circle in the table below the amount relevant to you. **The fee will be charged in the equivalent pound sterling.** For general guidance the conversion rate on 6 April 2011 was: £1 = \$1.62. *Please feel free to register for one, two or all three events.*

	<b>Reduced Fee</b> (until 29 <sup>th</sup> June 11)	<b>Full Fee</b> (from 30 June 11)
<b>P92 Training Course</b> 2-days (2-3 August)	900 (dollars)	1000 (dollars)
<b>Conference</b> 2-days (4-5 August)	400 (dollars)	500 (dollars)

## PAYMENT

### By bankers draft or bank to bank transfer to:

European Technology Development

(For payment by bank to bank transfer, account details will be supplied on request. Contact details are shown at the bottom of this form). *Please quote reference 'Course + Conf., Chicago 11' with the payment and state here how you paid or intend to pay:*

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**By Credit Card:** Major cards such as Visa/ Master Card/ JCB/ American Express/ Switch are accepted with the exception of Dinners Club. For security please *fax or post* this information.

Name of Account Holder		Amount to pay	\$
Card Type and No.		Expiry date	
Authorisation signature		Security code	

**Venue + Accommodation:** [Renaissance Blackstone Chicago Hotel >>](#)

**Delegate Details:** (Required for your badge)

Your **title** and **name:**

Company:

Position:

Address:

Phone:

Fax:

E-mail:

**REGISTRATION ADDRESS:** Please copy and post/ fax/ e-mail to address below:

Registration Section, European Technology Development, 6 Axis Centre, Cleeve Road, Leatherhead, Surrey KT22 7RD, UK

Enquires for registration or accommodation: [registration@etd1.co.uk](mailto:registration@etd1.co.uk)

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