

# 2-Day Training Course aimed at Industry

1



P/T 91

**WELDING, HEAT TREATMENT, OXIDATION,  
DAMAGE MECHANISMS, MICROSTRUCTURE,  
QUALITY CONTROL & LIFE ASSESSMENT**



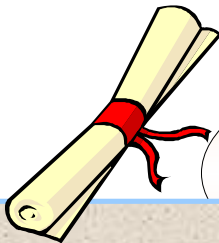
**Note:** This course on 8<sup>th</sup>- 9<sup>th</sup> Nov. will be run back-to-back (at the same venue) with the following **Optional** events (you can attend one or more events):

1) 1-day **Seminar & Discussion** on the use of new steels (P91, P92, P122, P23) in high temperature plant (10 Nov).

2) 1-day Training Course on **Life Assessment & Damage Mechanisms** (11 Nov)

3) 1-day Training Course on **Crack Assessment & Fitness for Service** (12 Nov).

>> To see further information and programme details please visit: [www.etc1.co.uk](http://www.etc1.co.uk)



2-Day Training Course

Venue: BALI HYATT SANUR, BALI,  
INDONESIA

Dates: 8-9 NOVEMBER 2010

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, weld repairs, sources of materials data, Type IV cracking, the effect of chemical composition details and other related issues.

This very popular course has been conducted regularly in London for the past 7 years and was recently also conducted in USA.

The speakers will be imminent workers in this field with the successful European and Japanese industry experience.

Training for Success

## WHY THIS COURSE ?

Recently there has been a concern in high temperature industry following a number of failures in **P91 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 or so). In the case of **T91 thin section components** recent findings from research and demonstration projects (supported by limited plant experience) have shown the **steam side performance** of this steel not as good as originally predicted with reports of replacement by some utilities of T91 superheater tubing after only a short service duration. Furthermore, recent work and publications by plant manufacturers, operators and researchers have shown that, unlike the traditional CrMoV steels, the **heat treatment** of this steel 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 P/T91 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 this steel but will continue to be followed or various reasons. Partly as a result of this, there is 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 and countries 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, a basic understanding of the underlying principles of this material behaviour 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   | § Planning   |
| § Maintenance   | § Component monitoring   |
| § Inspection - assessment of defect significance                        | § P/T91 similar and dissimilar metal welding and the weld assessment |
| § Insurance   | § Research and Development   |
| § Service provision   | § 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, material 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 performance in plant worldwide.

**Further information about ETD**, its projects [e.g. *Review of Experience with New Steels (P91/T91, 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**

## REGISTRATION & WELCOME 0900 – 0930 hrs

### Module 1: Material Properties and Heat Treatment

0930 – 1300 h (with 30 minutes break)

#### **Presenter**

*Dr A Shibli, ETD, UK*

#### **Objective**

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

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

- P91/ T91 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 components, hardness, microstructure etc.
- The effect of heat treatment (austenitising/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 1300 – 1400 HOURS

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

1400-1730 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 oxidation, research.
- T91 tubing demonstration and plant failure experience due to steam side oxidation.
- The effect of steam side oxidation on tube metal temperature for T91 tubing and its consequences.
- Effect of plant cycling on oxide spallation.
- Comparison of behaviour with traditional low alloy CrMoV steels.
- Damage effect of T91 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

#### **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 thick section 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 to low CrMoV steel welding, P91 austenitic stainless steel welding), the effect of cycling and lessons from plant experience.

LUNCH

1200 – 1300 HOURS

Training for Success

## **Module 4: P91 Quality Control & 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 component integrity can be assessed. What are 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 life assessment of P91 component integrity / life assessment.

Training for Success




The END



# REGISTRATION FORM (Please copy and e-mail / fax / post)

**New High Temp. Materials Seminar (10 Nov) + P91 Training Course (8-9 Nov)  
+ Life Assessment & Damage Mechanisms Training Course (11 Nov) + Crack  
Assessment & FFS Training Course (12 Nov) - Bali Hyatt Sanur, Bali**

## REGISTRATION FEE \*:

 Please circle in the table below the amount relevant to you. The fee will be charged in pound sterling. For general guidance the conversion rate on 1<sup>st</sup> January 2010 was: £1 = US\$1.50.  
*Please feel free to register for one or more events.*

	Reduced Fee (until 1 <sup>st</sup> October 10)	Full Fee (from 2 <sup>nd</sup> October 10)
<i>Seminar: New High Temperature Materials (10 Nov. 2010)</i>	£200	£225
<i>Course: P/T91 Advanced Steel (8-9 Nov. 2010)</i>	£700	£750
<i>Course: Plant Life Assessment &amp; Damage Mechanisms (11 Nov. 2010)</i>	£400	£450
<i>Course: Crack Assessment &amp; Fitness-for- Service (FFS) (12 Nov. 2010)</i>	£400	£450

\* **Note:** 20% discount for attending any 3 or more events or for group booking of 3 or more attendees from the same organisation.

## PAYMENT

<b>By bankers draft, or bank to bank transfer to:</b> 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). <i>Please quote reference 'Bali Events 10' with the payment and state here how you paid or intend to pay:</i> ..... .....			
<b>By Credit Card:</b> Major cards such as Visa/ Master Card/ JCB/ American Express/ Switch are accepted with the exception of Dinners Club. For security please <i>fax or post</i> this information.			
Name of Account Holder		Amount to pay	£ Sterling
Card Type and No.		Expiry date	
Authorisation signature		Security code	

**Venue:** Bali HYATT Sanur, Bali, Indonesia ([www.Bali.Resort.Hyatt.com](http://www.Bali.Resort.Hyatt.com))

**Accommodation:** Information on local hotels can be acquired by email to: [bali@matta-tour.com](mailto:bali@matta-tour.com)

**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)  
Tel: + 44 1372 363 111 or + 44 1372 363 112 Fax: + 44 1372 363 222