ETD Plant Services Newsletter

January 2023

ETD's Innovative Tools & Methodologies *for* Power, Process, Oil & Gas Plant

Complete Inspection, Monitoring & Assessment

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INTRODUCTION

European Technology Development (ETD) based in Surrey, just south of London, UK, will soon be reaching the milestone of quarter of a century of dedicated services to Power, Refining, Process plant and Oil & Gas industry worldwide. These services include full plant inspection and condition/ life assessment/ Fitness-for-Service/ RBM/ RBI/ Crack Assessment/ Weld Repairs and more for its existing repeat clients and new clients worldwide.

In addition to the traditional plant inspection and assessment, ETD uses some very specialised and innovative techniques, many developed by ETD in collaboration with the international industry, saving clients time and money and at the same increasing plant inspection cover and thus increasing plant safety and reliability.

The following pages describe a few innovative equipment developments by ETD and its industrial collaborators in Europe and Japan. ETD uses this equipment for providing services in complete plant inspection, monitoring and assessment. ETD can also sell some of this equipment and software and train interested parties in their use. Two more significant software systems developed by ETD are outlined on the last page.

Details of ETD plant services at:
www.etd-consulting.com/plant-inspection-integrity

For support please contact: enquiries@etd-consulting.com

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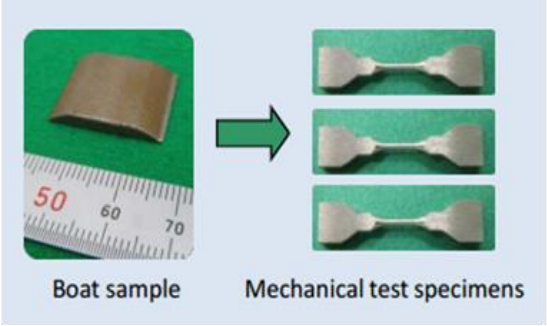
1) EDSE – Innovation in 'Boat Sampling'

The Electric Discharge Sampling Equipment (EDSE) was developed in collaboration with international partners to aid in the condition and life assessment of components. Unlike the traditional mechanical 'boat sampler', with EDSE, the surface loss, if any, is only of the level of fraction of a grain.



Industry Need: The most accurate way of determining an aged material's condition is through non-destructive, physical testing. For a large critical industrial component, this is obviously impossible without taking a sample. With the traditional mechanical cutting there is always a risk of component damage with possible stress concentrations thus shortening the component life. Furthermore, it may not be possible to cut samples in awkward and difficult situations and at acute angles. With the EDSE we have been able to design and modify the mounting frame and cut samples from inside the components in oil and gas industry, power and process plant piping, pressure vessels, rotors and even help entertainment industry to investigate cracks.

A recently completed ETD's project using EDSE in France, the video shows the EDSE mounted on a turbine rotor using magnetic mounts and a bespoke frame.

The Solution: Based on the EDM process, the EDSE cuts out small, thin sections of samples; leaving no sharp corners and without inflicting work hardening on the component surface. These samples can then be machined down to be used in creep, fatigue, tensile, toughness and hardness tests. The EDSE can cut out small slices between 1 to 20 mm thick and approximately 20mm^2, 40mm^2 or 40mm x 120mm from thick section components for their actual remaining life evaluation and extension.

EDSE is especially useful for investigating cracks in critical locations by cutting out samples containing crack tips.

Advantages of EDSE: An advantage of the EDSE system is that the resulting cavity leaves rounded edges with a 4mm radius and no stress concentrations. The process of cutting uses a consumable electrode that removes material via electric spark erosion, with purified water to remove debris and provide a cooling medium. The cutting time for a standard specimen is about 1.5 hours and the EDSE can be used on horizontal, vertical and angled surfaces by either strapping to the component or through the use of a magnetic mount.

Recently Completed Third Party Project Using EDSE

Use of Electrical Discharge Sampling Equipment (EDSE) at a Refinery Plant in Asia

ETD is pleased to announce the successful recent completion of an EDSE project.

An Asian plant approached ETD to cut out three '16 mm thick boat samples' from the inside of a vessel that was difficult to access.

The challenge was met by modifying the frame according to the drawings and trial runs before successfully cutting the specimens.

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2) Portable Scanning Force Microscope (SFM)

A Portable Microscope for In-Lab. and On-Site Use in Multiple Industrial Sectors – Power, Process, Aerospace etc. for early-stage damage and microstructural studies

As Powerful as an SEM !

What is an SFM?

SFM is a portable version of the Atomic Force Microscope that has been developed for on-site damage and microstructural imaging of critical components in industry or other large structures – metallic or non-metallic.

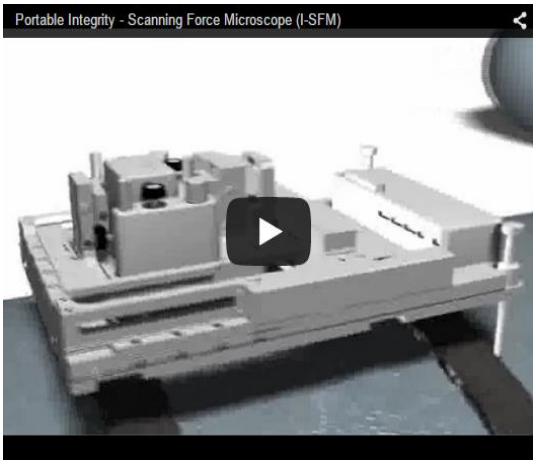
Advantages Over Current Tools

SFM has the following significant advantages over the other NDT and diagnostic tools currently in use:

• The **ability to view defects in 3D at the nano scale (with sizes of the order of 0.01-0.1 microns) allows for early-stage damage detection that would not be picked up by most other NDE techniques.** This has been particularly useful for **P91** type in-service component investigation where micron size creep cavitation develops only late in life and thus early damage can be missed by most of the traditional NDE techniques.

• SFM can be used **on-site and attached directly to the component** being investigated after polishing the area under study to 1 micron level (same as for replication) and etching.

SFM mounted on a pipe and a turbine rotor.
Once mounted the SFM movement and scanning is controlled by a laptop which displays and stores the material defect and microstructural images/ features.



This video shows the microscope which is fixed to a mobile frame that sits on a fixed frame which in turn is attached to the component under investigation.

Recent Sale of Portable Scanning Force Microscope (P-SFM) to a Power Utility in Asia

ETD's portable Scanning Force Microscope (SFM) has recently been purchased by an Asian power utility. After ETD's initial R&D work for the client followed by the successful study and life assessment of P91 components in the client's plants, the utility engineers and managers decided that it was an investment worth making.

SFM's electronics has now been made more compact and the new model can be powered by **solar charged battery** so no need to connect SFM to electricity mains and the use of long electricity cables causing safety issues.

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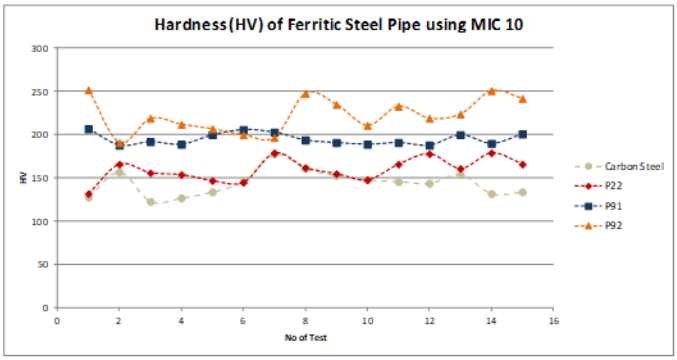
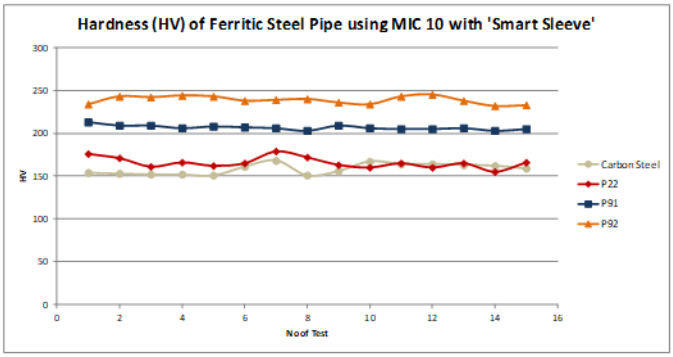
3) ETD's Portable 'Precision Hardness Testing'

ETD has now developed a portable 'precision hardness testing device' known as 'Smart Sleeve'. We have carried out initial test trials on various steel pipes, tubes and plates giving excellent results with a general scatter of about +-3 VPN, compared with a usual scatter of +-20 VPN or more. Smart Sleeve is being used by ETD with MIC10 although it can be designed to fit any portable hardness tester. 'Smart Sleeve' incorporates sophisticated electronics and software which keeps the hardness tester normal to the test surface. Graphs below show the results of hardness on ferritic alloy steel pipes, (Carbon Steel, P22, P91 and P92) using MIC10 with and without 'Smart Sleeve'.

'Precision Hardness Tester' in action

Results





Results of hardness testing of ferritic steel pipes (Carbon Steel, P22, P91 and P92) using MIC 10 - with & without 'Smart Sleeve'

Third Party Plant Inspection Using 'Smart Sleeve'

ETD is pleased to state that after extensive tests and trials, for the past few years ETD has been using 'Smart Sleeve' commercially on a number of plants in Asia and Europe.

A few years ago, Remaining Life Assessment (RLA) of one of the boilers of an Asian utility was carried out using Smart Sleeve. Since then, this utility has insisted on the use of Smart Sleeve on their critical boiler components. The full RLA work involved performing on-site inspections - UT thickness measurements of tubes (wall thickness & bore oxide scale), replication, hardness measurement using Smart Sleeve of selected components from FSOH and ROH. The inspection data was then used to estimate tube metal temperature and identify material degradation which could then be used for damage assessment and for predicting the remaining life of outlet headers and tubes.

4) LFET, BFET – Fast boiler tube scanning for wall thinning

Low Frequency and Balance Frequency Electromagnetic Testing is a relatively new service that ETD has been providing to its customers over the past five years or so. The idea is to rapidly scan boiler tubes for wall thinning, corrosion pitting or gouging etc. to identify suspect areas, carry out UT spot checks of the suspect areas for more quantitative study of the tube damage, if necessary, and take remedial actions. This can significantly reduce tube inspection time, saving money to the plant owners and operators, increasing plant inspection cover and increasing its safer operation and reliability.,

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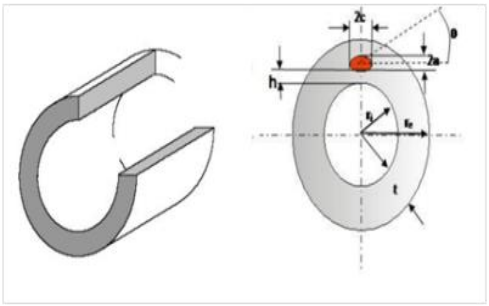
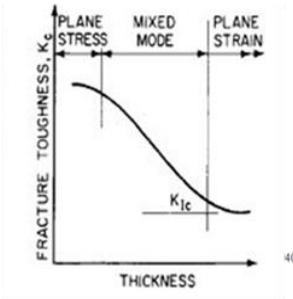
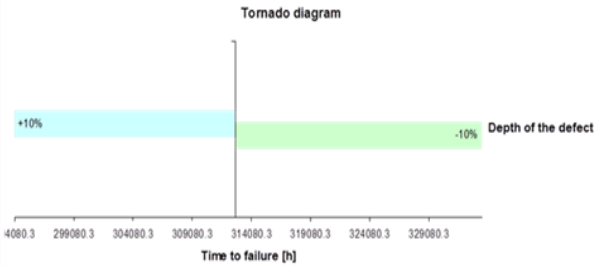
ETD Developed Two Software Systems

i) 'Crackfit' for Boilers and Turbines

ETD's existing **procedure/software 'Crackfit'** deals with the assessment of cracks in both the low and high temperature, high pressure equipment. At present it covers 17 geometries of pressure vessels/piping components and cracks (embedded, surface emerging, thumbnail front etc.) typically found in power plant boiler and process plant.







ETD has now added a few turbine crack geometries typical of cracks often found in turbines.

Both the existing owners of the Crackfit and potential new buyers are welcome to subscribe to this new and expanded procedure/ software. More information from: enquiries@etd-consulting.com

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ii) Boiler Life Assessment Software (BLAS)

This is a recently developed Software for the ease of the life assessment of boilers and HRSGs, with easy inspection data input and life assessment.
Equally useful for the new and experienced life assessors.

For details please write to:
enquiries@etd-consulting.com