

In-Situ Metallographic Replication in Saudi Arabia

Codes and Standards

Scope:

- ASTM E3: Preparation of Metallographic Specimens
- ASTM E7: Terms relating to Metallography
- ASTM E407: Standard for Micro-etching Metals and Alloys
- ASTM E1351: Field Metallographic Replicas

After carefully reviewing and accumulating all knowledge about the operating conditions and stress analysis of the component, the inspectors from TCR Arabia carefully choose a location of the component for in-situ Metallography. This location (area) is polished using custom TCR-developed tools (portable grinding machine or by electrochemical means) and then etched in a suitable medium. Portable microscopy is then performed to ensure that a good clean etch has been established. Onto this etched surface, a sheet of acetate type film is placed and partially dissolved with a solvent. The etched structure is then imposed on the acetate film as a replica image. The acetate is removed from the surface and secured to a glass microscope slide.

Observations can be made both in the field as well as at the laboratory. For field use, a portable microscope (400X magnification) is used to observe prepared metal surfaces and the quality of the replica. A portable microscope with photographic capabilities can also be used to provide digital or positive prints of the examined areas.

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- At the laboratory, detailed microscopic examinations are made, including digital photographs to document the microstructures collected in-situ. TCR Arabia has access to creating images of Metallurgical replicas on a scanning electron microscopes (SEM).
- The Microstructure Characterizer Software developed by TCR, assists analyzing the image to determine the microstructural degradation due to creep and calculates the graphitisation, depth or width of Decarburisation, Phase/Volume percentage, grain growth, Inclusion Rating, Particle Size and volume percentage, Particle Count, Porosity and Coating thickness.
- TCR Arabia has custom developed special purpose in-situ polishing devices which assist to enable metallographic polishing in difficult locations and allows the field services team to carry out high quality replication even on warm components.
- TCR Arabia can also develop a data bank of critical components of equipment of process plant by periodical monitoring for preventive maintenance and planning for inventory control. TCR can provide suggestions on repair welding of used components of process plants

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Metallurgical Replication, Observation and Interpretation

TCR Arabia adheres to the guidelines presented in ASTM E 1351 (Standard Practice for Production and Evaluation of Field Metallographic Replicas). Replicas are developed with or without gold sputtering and analyzed by our team. Using the replication methods our experts can verify microstructures of a given component.

At TCR we have multiple sets of the following In-Situ Metallography kits/equipment:

- Insipol 2000 and advanced electrolytic flow type polisher and etcher
- Portable rough grinder with self adhesive papers
- Portable fine polishing (mini grinder)
- Portable microscope capable up to 400X magnification
- Replica kit, we use specialized plastic based slides for replica preservation which has longer durability and easy to handle at site.
- We have 5 teams comprising of expert Metallography technicians capable to deliver quality and satisfactory services.



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Information requested for replica interpretation

- Objective of In-situ Metallography - Condition assessment, fire/damage assessment, remaining life assessment, or base line data generation
- Material of construction with exact specification
- Location of replication with sketch
- Process parameters and design parameters
- Service life of the component at the time of replication.
- Any history of previous failures at the location of replication.

Documentation And Reporting Of Test Results

Each examination shall have the following:

- Report no., TCR job no.
- Client name, Project ID and Location
- Item under examination.
- Identity of replica sample.
- Etchant employed.
- Micrograph observations, including magnification and comments.
- Photographic or similar location device to indicate from where replica taken.
- Date of examination.
- Technician undertaking procedure.