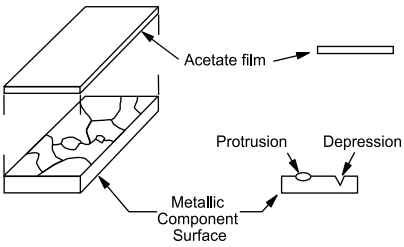
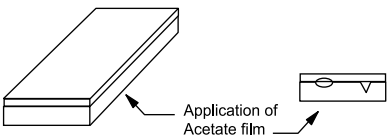
Field Metallurgical Replication

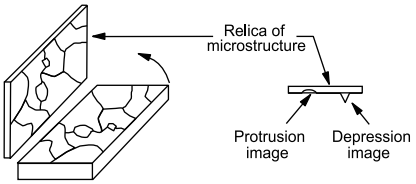
Field Metallurgical Replication (FMR) is often the least disruptive and most cost effective option for metallurgical examination when making important run, repair or replace decisions.

FMR is a non-destructive metallurgical inspection technique that is used for evaluating plant equipment such as heaters, boilers, piping and reactors. By comparison, cutting samples for laboratory testing is often more expensive, takes the equipment out of service and can be difficult to repair.

FMR is a simple process. Using portable equipment, the metal surface is ground and polished to a mirror finish. The polished surface is subsequently etched to reveal the microstructure. A replica of the etched surface is then made with a thin piece of acetate film.

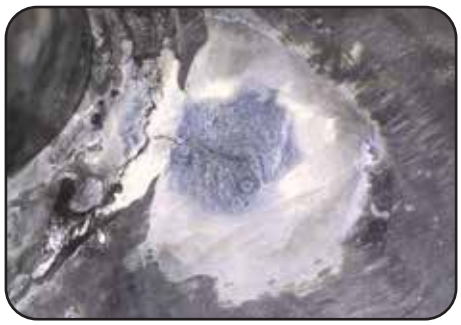






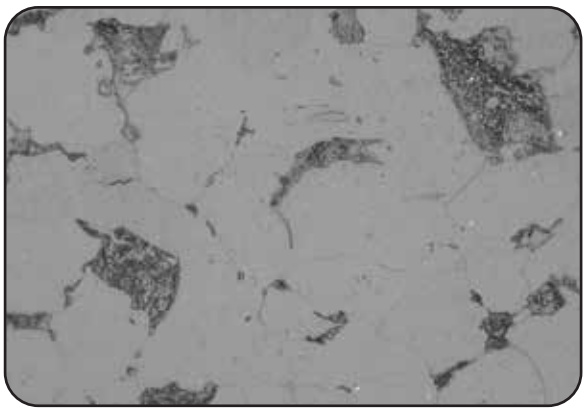
The replica can then be examined in the field using a portable optical microscope or in the laboratory. This process gives our metallurgical engineers the ability to examine microstructural features such as grain size, cracks, carbides, creep and other damage mechanisms. It can confirm observations made by other nondestructive methods such as acoustic emission tests, penetrant examination and ultrasonic flaw detection and take those evaluations a step further to identify the nature of the flaw. For example, whether a crack is intergranular corrosion or transgranular fatigue can be determined.

Polished FMR site on a boiler tube



FMR showing cracked nozzle adjacent to weld and through base metal

In-situ surface preparation



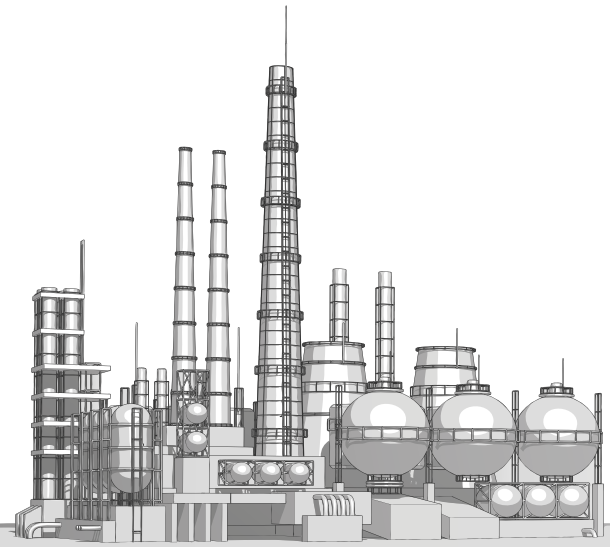
Microstructure of carbon steel, showing ferrite and pearlite matrix on a field replica

Replication site across a weld joining a large diameter tee and pipe

FMR should be considered if a component is in high temperature service or requires the use of a non-destructive technique. One major advantage is that you don't have to cut any samples for analysis and the equipment may not need to be taken out of service for this inspection. When evaluating plant equipment, field metallurgical replication can be an important tool for making run, repair or replace type decisions.

All questions of service life involve materials. Stress Engineering Services has an extensive staff of highly qualified materials engineers and metallurgists strategically located in offices throughout North America (Houston, Cincinnati, and Calgary), all devoted to diagnosing the material's suitability for continued service.

Stress Engineering Services can provide teams of metallurgists and technicians to conduct the in-situ FMR assessments or, if needed, leverage resources back at our laboratories. This approach enables us to quickly assess degradation mechanisms that impact the service life of your equipment. These results can also be used as important inputs in fitness-for-service assessments (e.g., API 579-1ASME FFS-1).



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