



WARREN

Fracture Surface Protection

Copyright 2002, Revised 2013

When a component fractures into two or more pieces, the exposed surfaces contain many features that indicate why and how the fracture occurred. In order to accurately determine the root cause of the break, the failure analyst must have an opportunity to read the unaltered fracture surfaces. Damaged surfaces from improper handling, corrosion, etc. can lead to misinterpretation or an inconclusive investigation.

Fracture surfaces, although usually made of durable material, are quite delicate. Under a microscope, one can see the thousands of peaks and valleys, ridges and dimples that make up a fracture surface. These features provide a time history of the fracture and can be literally erased by just one ill-placed scratch. The following is a list of steps to take when preserving a broken part for further analysis:

First Things First - Document and Protect

A chain of custody must be developed for the fractured component if it is to be used as evidence in a contested matter. Prepare an evidence transfer worksheet for the part so that a paper trail for the part is created that summarizes shipping, handling, and possession. Have the persons sending and receiving the part sign the form each time the part is transferred from place to place.

Fractured parts, especially metallic components, can oxidize or rust and degrade in storage. Be proactive and have the fractured components documented as soon as possible by a trained failure analyst.

Always avoid the strong urge to put the fractured pieces back together. It is impossible to manually mate the two parts together again. Additionally, the mismatch between the pieces will damage the surface features, especially the high spots, and will be evident under magnification. Once the fracture surfaces are exposed, protect them from all contact, especially from hard objects that can smear, gouge and scratch.

Handling and Storage

Avoid touching the fracture surface when handling each component. Handling with your bare hands will leave a residue which can initiate premature corrosion, depending on the material. Handling may also remove certain deposits relevant to the investigation. Remember that the less contact the fracture surface sees, the better the chances for an accurate and cost effective interpretation.

Corrosion should be a concern when a fracture surface cannot be taken to a dry, clean laboratory environment immediately. Special steps in this case should be taken to

protect the fracture surfaces from elements that may alter the surface through corrosion or chemical attack. Petroleum products are commonly used as a sealing medium against environmental attack because they are accessible and can be easily removed with standard solvents. A light coating of WD-40 or light mineral oil can be very effective. Under more aggressive environments, a layer of petroleum jelly or clean grease will provide a more durable seal. Always remember to send a clean sample of the sealing medium with the part just in case it has some bearing on the investigation.

Shipping and Storage

Protecting the surfaces from mechanical damage due to moving or shipping is clearly important. Clean bubble wrap makes an excellent choice. Clean, layered polyethylene film is also a good choice. Avoid fibrous materials such as paper, cardboard, or fabric. These materials will leave debris behind on the relatively jagged fracture surfaces making cleaning more difficult and expensive. The debris may also bring about misinterpretation.

Modifying the Part

At times, a fracture surface, or portion of a fracture surface must be removed from a larger component for analysis. High magnification scanning electron microscopy usually requires small samples, for example. Prior to altering the part, remember to fully document the component in its original fractured position with photography. It is also a good idea to document the sectioning plan with photography, and sketches so that location and orientation of all parts can easily be recreated and described.

Removing a fracture surface from a larger part is a critical step. Heat generated from the cutting process can easily change the metallic microstructure of many materials. Thought should be given to the cutting method so that heat generation is minimized in the area of the break. Torch cutting should be used as a last resort and no closer than six inches to the areas of concern. Heat damage from torch cutting and other aggressive methods can be minimized by applying a continuous water stream in the cut area. This cutting and preservation of the fracture surfaces should be done under the monitoring of a skilled engineer or metallurgist. We all know that evidence can make or break a case. If a trial is going to be influenced by the evidence presented, that evidence must not have its admissibility questioned due to casual handling. As discussed in this article, it is not only a matter of securing the evidence; it is important to follow the proper protocol in evidence management:

1. Document the chain of custody and protect the evidence from damage or deterioration.
2. Handle and store the evidence using procedures and materials that will not damage the evidence or exacerbate the damage already done.
3. Do not attempt to modify the evidence in any way by removing parts or trying to put parts together.
4. By following these steps, you will avoid unwanted challenges to your case and your evidence will be trial ready.