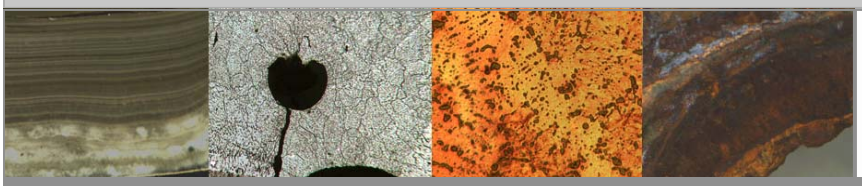
NUTS & BOLTS



New Hampshire MATERIALS LABORATORY, INC.
Your Problem Solving Partner

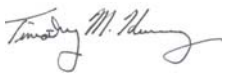
INSIGHTFUL FAILURE ANALYSIS IN 6 STEPS **JUNE 2013 ISSUE 9**

Welcome to New Hampshire Materials Laboratory

The Insightful Failure Analysis in 6 Steps article was originally published in our Nuts & Bolts back in the Winter of 1997 in Volume 6. We decided to republish this because the failure analysis is the Sherlock Holmes of industry.

This article provides you with an outline of the steps taken during a failure analysis and hopefully a better understanding of how a failure analysis can help you solve a problem within your company.

To find out more on how we can be "Your Problem Solving Partner" visit our website at www.nhml.com.



Tim Kenney, Laboratory Director

Insightful Failure Analysis in 6 Steps

In a manufacturing world filled with TQM teams and ISO-9000 audits, customers are demanding effective corrective actions. Around the coffee machine, part failure is blamed on misuse by the customer, or poor product assembly. Maybe, it's a lack of maintenance or design errors. A scientific analysis of the failure can get to the root cause of the problem and usually, solve it for good.

Manufacturers and service providers from job shops to billion dollar multinationals have relied on scientist to identify the problem and recommend corrective actions. For many, the cost of the analysis are recovered in reduced warranty costs and greater customer satisfaction.

The investigative process is iterative. So, it is easy to proceed in routine steps (see below). This is a plus for the manufacturer who must determine if the cost of the analysis outweighs the cost of simply replacing the part. Proceeding in steps manages the cost of the investigation, while revealing key physical clues that may solve the problem forever.

Continued on page 2

Step 1: Gather Data and Samples:

The pieces of the failed part must be collected and stored in a fashion that will avoid corrosion on the fracture surfaces. Never touch the fracture surfaces or fit them back together. These will damage the surfaces. Be sure to report the conditions of operation, details on the failure itself and background on the supplier and the part history. Knowledge of recent design changes can be especially helpful.

Step 2: Examine Visually:

Once the background information is collected, the failed part is examined under low power magnification to determine the type of fracture. Fracture surfaces have "profiles" that are interpreted by an experienced analyst. When more detail is needed, a sample of the part may be prepared and examined under higher magnification to reveal anomalies in the material structure or on the fracture surface. Often this visual analysis provides conclusive results. However, sometimes more information is required.

Step 3: Prepare the Test Plan:

The test plan defines the tests and conditions required to more fully evaluate the material. In most cases, the material is tested for conformance to the design specification. Failure to meet the specification is not necessarily the cause of failure.

Step 4: Analyze Sample:

The materials are analyzed in accordance with the test plan. Routine test include chemical analysis or mechanical testing for strength or hardness. If these results are not conclusive, testing under simulated conditions may be necessary.

Step 5: Test Under Simulated Conditions:

It is always helpful to have an exemplar (a reference sample) available during the analysis of the failed part. Comparing "good" and "bad" parts can save both time and money. A "good" part can answer many of the questions generated in the analysis. It can also be used when "simulated conditions" testing is required.

Step 6: Present Conclusions & Recommendations:

Once the analysis is complete, you will be presented with results and recommendations. Be sure the report includes the methods used to determine the cause of failure. The report should also include copies of any photographs or photomicrographs that were taken. These may be useful, if the problem is attributed to a customer or supplier part.

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