

## Failure Analysis

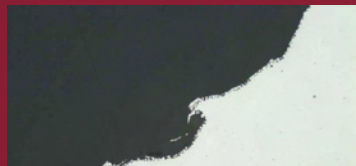


*As received and macroscopic views of failed fastener sample*

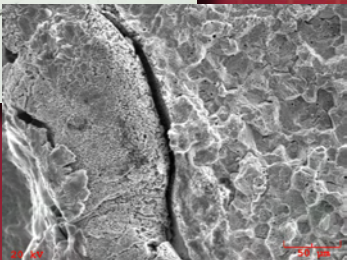


The IMR Failure Analysis group specializes in field failures, manufacturing process problems, defect detection, evaluation of life cycle failures, coatings failures, corrosion and environmental effects. We have performed thousands of failure investigations for clients in a wide range of industries, on a wide range of samples and materials.

Our reports are clear, concise explanations, providing a clear picture of the root cause. We can also offer recommendations to prevent future failures.



*Cross section through fractured bolt and SEM image of fracture surface*



## Not just data, *knowledge*

### **IMR Test Labs**

131 Woodsedge Drive  
Lansing, NY 14882 USA  
1-607-533-7000  
sales@imrtest.com

### **IMR Metallurgical Services - Louisville**

4510 Robards Lane  
Louisville, KY 40218 USA  
1-502-810-9007  
sales@imrlouisville.com

### **IMR KHA - Portland**

5687-A SE International Way  
Portland, OR 97222 USA  
1-503-653-2904  
sales@imrportland.com

### **IMR Test Labs - Singapore**

30 Loyang Way #03-16  
Singapore 508769  
+65 6592 5325  
sales@imrsingapore.com  
www.imrsingapore.sg

### **Coming - Summer 2012**

### **IMR Test Labs - Suzhou**

Jiangpu Road 75, Shengpu Town  
Suzhou Industrial Park  
Jiangsu, China 215126  
sales@imrsuzhou.com  
www.imrsuzhou.com

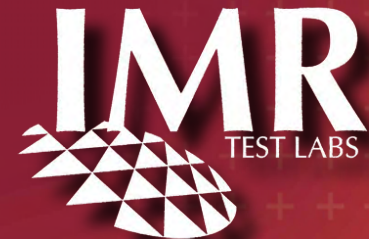
**[www.imrtest.com](http://www.imrtest.com)**

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## Fastener Testing Services



Not just data, *knowledge*

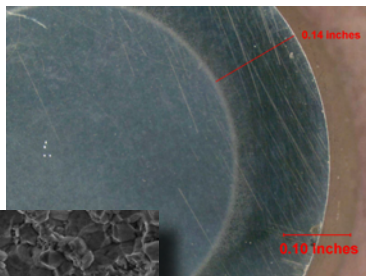




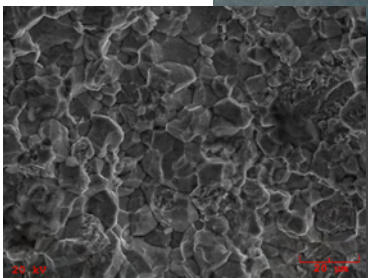
*Inclusion Rating and Grain Size of a fastener as polished 100x*

## Metallurgical Analysis

Intergranular Attack  
 Microstructure  
 Case Depth  
 Thread Profile  
 Thread Imperfection  
 Microhardness  
 Plating Identification  
 Plating & Coating Thickness  
 Scanning Electron Microscopy



*Case Depth and Intergranular Fracture of a fastener - as polished*



## Mechanical Testing

Tensile (to 160,000 lbs)  
 High Temperature Tensile (to 2100F)  
 Axial & Wedge (up to 1/2 inch)  
 Proof (internal & external threads)  
 Shear  
 Stress Durability  
 Hydrogen Embrittlement  
 Coating Thickness  
 Hardness  
 Torque Testing to 600 ft-lbs  
 Creep/Stress Rupture



*Intact bolt in 10 degree wedge fixture*



*Ithaca's ICP Chemical Analysis Lab*

## Chemical Analysis

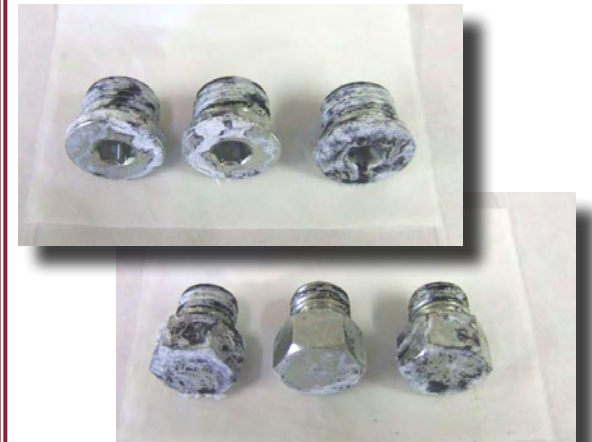
Chemical Analysis (ICP, OES, XRF)  
 Combustion (C, S, O, N, H)  
 Unknown Material Identification  
 Alloy Verification  
 Cleanliness  
 RoHS Compliance



## Corrosion Testing

Salt Spray  
 Cyclic Corrosion  
 QUV  
 Humidity Exposure  
 Immersion Corrosion

*Fastener Samples showing white corrosion after 96 hours of continuous salt spray*



## Accreditations

A2LA (ISO 17025)  
 Nadcap  
 GE S-400  
 Approvals from many major suppliers.  
 To see all of our accreditations visit us at [www.imrtest.com](http://www.imrtest.com)