

# TRIBOLOGIK® NEWSLETTER

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June 2015

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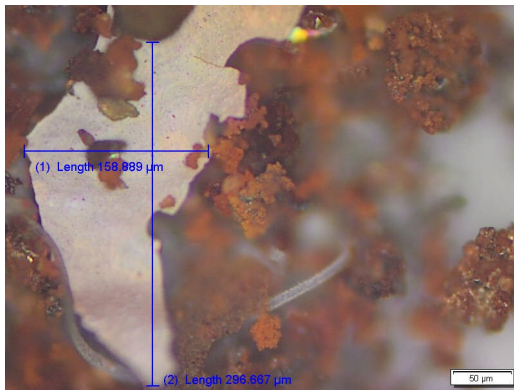


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## ANALYTICAL FERROGRAPHY A Sophisticated Diagnostic Procedure – Part 2



In the April issue of this Newsletter, we have seen how analytical ferrography allows detecting large wear particles and contaminants and show such details as the type of wear (e.g. : bearing), shape and dimensions.

Such a high degree of accuracy permits identification of the source of degradation of your equipment and pinpoints the deteriorating part(s) or component(s).

In order to reach this high level of precision, it is of utmost importance that the observations of the technician on the composition, appearance, color, size, quantity or position of the wear particles on the ferrogram<sup>1</sup> be precisely recorded.

<sup>1</sup> A ferrogram is a glass slide supported over a magnetic field on which a diluted oil sample is poured (through a thistle tube). The magnetic field separates the particles from the oil. When separated, particles are distributed differently on the slide if ferrous or non ferrous. Large ferrous particles will be deposited on the entry end of the slide and often pile up. In order to aid the identification of composition, the analyst will heat treat the slide for two minutes at 600°F.

There are two main categories of particles : ferrous and non-ferrous.

## Non-Ferrous Particles

- **White nonferrous particles**
  - Composition: aluminum or chromium.
  - Appearance: bright white both before and after heat treatment.
  - Deposition: randomly across the slide; larger are collected against the chains of ferrous particles.
  
- **Copper particles**
  - Composition: copper, copper alloy
  - Appearance: bright yellow both before and after heat treatment. Surface may change to verdigris after heat treatment.
  - Deposited randomly with larger particles resting at the entry point and getting smaller towards the exit.
  
- **Babbitt particles**
  - Composition: tin and lead.
  - Appearance: gray, sometimes with speckling before heat treatment. Still mostly gray after heat treatment, but smaller, with blue and red spots.
  - Deposited randomly, not in chains with ferrous particles.
  
- **Contaminants**
  - Composition : usually dirt (silica), and other particulates.
  - Appearance: white crystals, somewhat transparent, no change after heat treatment.
  - Deposited randomly, commonly dyked by the chains of ferrous particles.
  
- **Fibers**
  - Composition : typically from filters or outside contamination.
  - Appearance: long strings allowing light to shine through. Variety of colors, do not change after heat treatment. Can act as a filter, collecting other particles.
  - Deposited anywhere, but tend to be washed towards the exit end.

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## Ferrous Particles

Large ferrous particles will be deposited on the entry end of the slide and often pile-up top of the other. Ferrous particles are identified using the reflected light source on the microscope. Transmitted light will be totally blocked by the particle.

There are five types of ferrous particles:

- **High Alloy Steel**
  - Appearance : gray-white before and after heat treatment.
  - Deposited as chains on the slide. If it is white and appears in a chain, it's deemed to be high alloy. Otherwise, it's considered white nonferrous. The frequency of high alloy on ferrograms is rare.
  
- **Low Alloy Steel**
  - Appearance : gray-white before heat. Usually blue after heat but can also be pink or red.
  - Deposition : Particles are also found in chains.
  
- **Dark Metallic Oxides**
  - Appearance : Dark gray to black both before and after heat treatment. The degree of darkness is indicative of the amount of oxidation.
  - Deposited in chains.
  
- **Cast Iron**
  - Appearance : before heat treatment and a straw yellow after the heat treatment.
  - Deposition : they are incorporated in chains amongst the other ferrous particles.
  
- **Red Oxides (Rust)**
  - Appearance : "beach" of red sand.
  - Deposition : in chains with the other ferrous particles and sometimes randomly deposited on the slide surface. A large amount of small red oxides on the exit end of is generally considered to be a sign of corrosive wear. To be continued in the next issue of Newsletter.

Source : Noria – Machinery Lubrication

**For additional information, contact your account manager.**

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