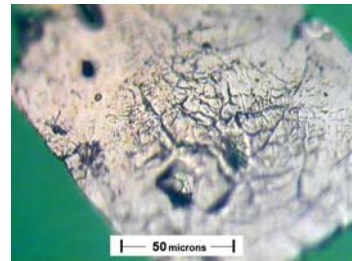


The most powerful diagnostic tool in wear debris analysis is **Ferrographic Analysis**.

**Ferrographic Analysis** will probably be the only test that can justify shutting down a piece of equipment.

**Ferrographic Analysis** consists of detailed microscopic examination of a slide to determine :

- Wear Debris Particles ; size , shape , texture and relative concentration
- Metallurgy of wear debris particles , both ferrous and nonferrous
- Wear mechanism indicating root cause
- Component source or origin of wear debris particles
- Identification of contaminants



**Bearing Wear**



Ferrographic Analysis Result

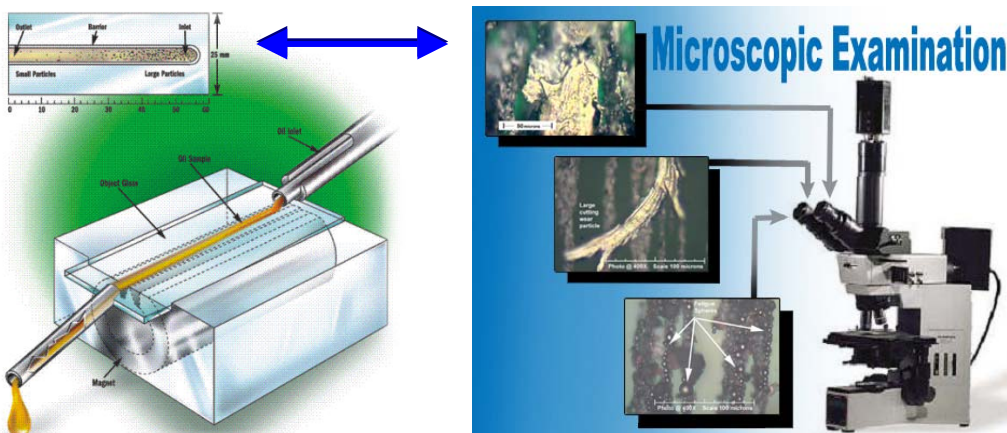


Spalling of inner race and rolling element

### Vertical Pump

Ferrographic Analysis could detect and provided warning this bearing failure mode in early stage.

A **ferrographic Analysis** slide is created by passing an oil sample along a glass slide over a strong magnetic field as illustrated in picture below

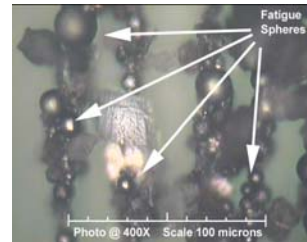


The slide captures both ferrous and nonferrous particles along with contaminants and upon heating can reveal additional information on the particle type such type of alloy.

## Ferrographic Analysis v.s. Root Cause

**Ferrographic Analysis** also can be used for root cause analysis in evaluating equipment failures. Root causes that can be determined through this technique include:

- Over loading
- Over heating
- Over Speed
- Lubrication Starvation
- Contamination
- Early stage of rolling element failure
- Misalignment and imbalance
- Etc.

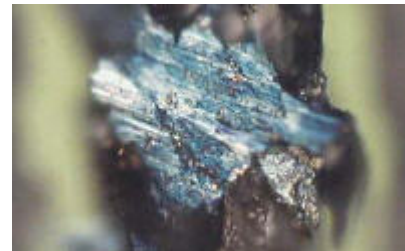


**Fatigue Spheres**  
**Early sign of rolling element**

## When and Why to use Ferrographic Analysis

The following checklist can help you determine when this technique is appropriate:

- Elemental Analysis or Spectrometric Analysis by routine oil analysis , indicates an abnormal wear condition or abnormal wear trend .
- Machines or Equipments are exhibiting unusual characteristics, such as overheating, high vibration readings, unusual sounds and high  $\Delta P$  readings across a filter.
- Machines or Equipments are highly critical in operation .



**Gear Wear**

Critical equipment should have a **Ferrographic Analysis** done once a year as a minimum

- High failure rates experienced on startup of new or repaired equipment due to infant mortality caused by material defects , design problems or improper assembly.  
(Routine oil analysis together with **Ferrographic Analysis** , should be perform after start – up )

- A new oil analysis program is established. (**Ferrographic Analysis** should be run on Critical equipment to establish baselin data )

