



Generic Guide – Component type, metallurgy and equipment operating environment knowledge are also key factors in analysing used lubricants to determine machine condition.

## Possible Element Originating Source Chart

### Metals

Lead	Overlay of most main/rod bearings.
Iron	Wear originating from rings, shafts, gears, valve train, cylinder walls, and pistons in some engines
Aluminium	Indicates wear of pistons, rod bearings and certain types of bushings. Can be a component of silicon
Copper	Wear from bearings, rocker arm bushings, wrist pin bushings, thrust washers, other bronze and brass parts. In some transmission, wear from discs and clutch plates.
Chromium	Primary sources are chromed parts such as rings, liners, etc., and some coolant additives.
Tin	Indicates wear from bearings when babbitt overlays are used. Also an indicator of piston wear in some engines.
Nickel	Secondary indicator of wear from certain types of bearings, shafts, valves and valve guides.
Silver	Wear of bearings which contain silver. In some instances, a secondary indicator of oil cooler problems.
Titanium	Alloy in high quality steel for gears and bearings.

### Contaminants

Silicon	A measure of airborne dust and dirt contamination, usually indicating improper air cleaner service
Sodium	Coolant additive; used as an additive in some oils. Can also indicate water ingress or condensation due to prolonged periods of shutdown.
Vanadium	Heavy fuel contaminant - trace element.

### Additives

Magnesium	Dispersant, detergent additive, alloying metal.
Zinc	Antioxidants, corrosion inhibitors, anti-wear additives, detergents, extreme pressure additives.
Molybdenum	Indicates ring wear. Used as an additive in some gear oils.
Calcium	Detergents, dispersants, acid neutralizers.
Phosphorous	Antirust agents, spark-plug and combustion chamber deposits.
Boron	Coolant additive; used as an EP additive in some gear oils to improve load handling characteristics.
Barium	Corrosion inhibitors, detergents, rust inhibitors



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**Hydraulic Systems**

<b>Iron</b>	Cylinders - Rams, Cylinder rods, Pump, Pump Bearings.
<b>Aluminium</b>	Cylinder rod bushing, dirt ingress, pump body ( some )
<b>Copper</b>	Cooler core leaching, Some Pump Cylinders, Bronze Flex plate ( vane pump ), Pressure plate ( gear pump ), Pump bushing, Slippers & port plate ( piston pump ), brass cage bearings, Swash plate cups, pump pistons ( some )
<b>Chromium</b>	Cylinder rods, Pump rings ( some ), Pump bearings
<b>Tin</b>	Indicates wear from bearings when babbitt overlays are used. Also an indicator of piston wear in some engines.
<b>Nickel</b>	Cylinders - Rams, Pump, Pump Bearings.

**Industrial Gearboxes**

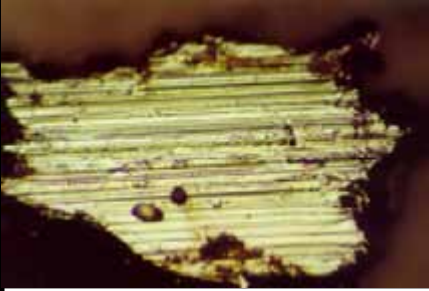

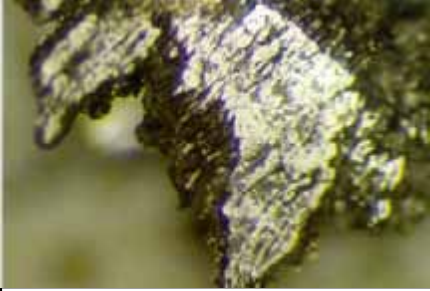
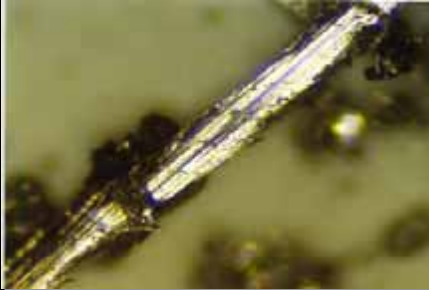
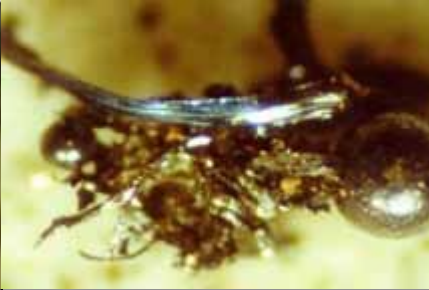
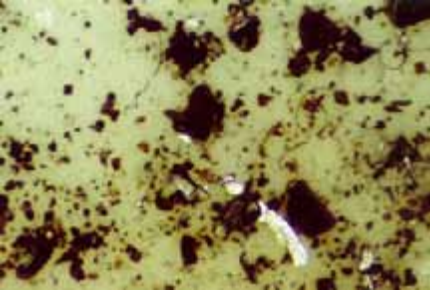
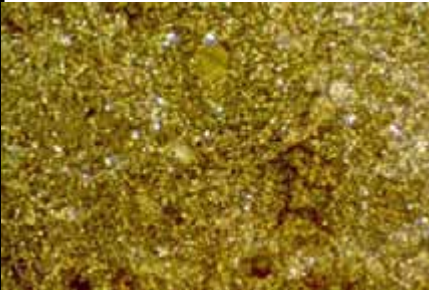
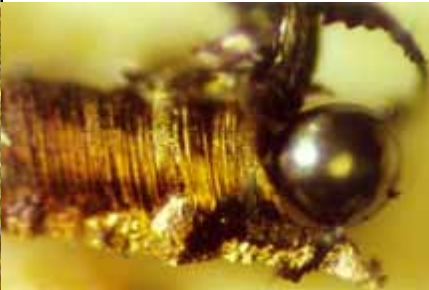
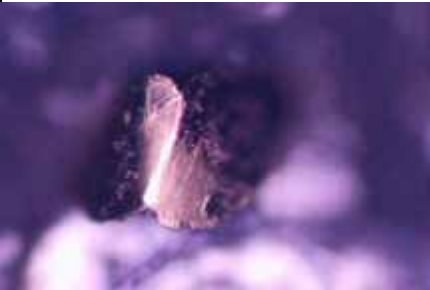
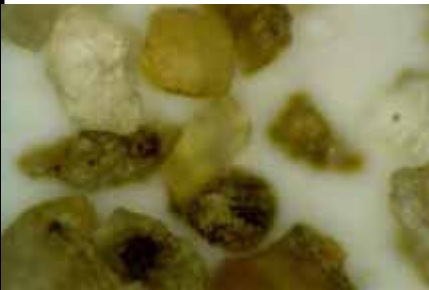
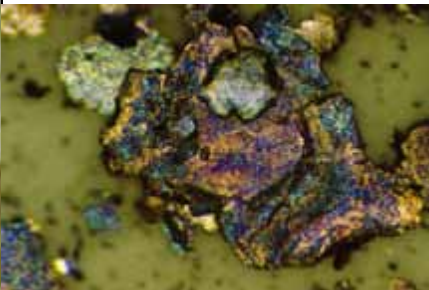
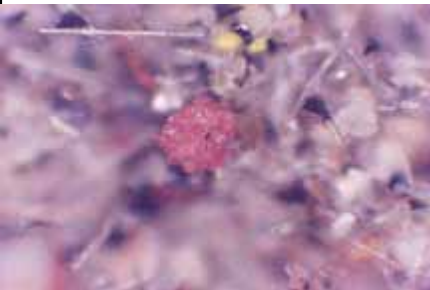
<b>Iron</b>	Gear Teeth, Bearings, Shaft
<b>Aluminium</b>	Dirt ingress, anti seize, bushes and bearings ( some )
<b>Copper</b>	Ring gear ( worm drives ), brass cage bearings
<b>Chromium</b>	Shaft ( some ), Roller bearings,
<b>Nickel</b>	Bearings.

**Compressors**

<b>Iron</b>	Gear Teeth, Bearings, Shaft, valve train, cylinder liners, oil pump, screws.
<b>Aluminium</b>	Dirt ingress, anti seize, bushes and bearings ( some ) , thrust washers, pistons, Rotors, Impellers
<b>Copper</b>	Brass cage bearings , Washers, Oil cooler leaching.
<b>Chromium</b>	Valves, Cylinder liners, Shaft ( some ), Roller bearings, Piston rings
<b>Nickel</b>	Bearings, Gears and Shafts, Liners.

# Oil Test

## Wear Debris Analysis Reference Chart

		
Sliding Wear	Laminars	Fatigue Chunks
		
Sliding Wear Needles	Cutting Wear – Two Body	Cutting Wear – Multi Body
		
Black Oxides - Fretting	Spheres	Non-Ferrous Chunk
		
Silica	Heat Tempering	Red Oxides (Rusted Particles)