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Sources of Elements

Tin

1. As an overlay on pistons to facilitate wear-in.
2. It could be used elsewhere in equipment as a sacrificial overlay of a moving component: to facilitate wear-in.
3. It is a component in bronze and brass.
4. It is a component in many types of solders.
5. It is a component in many types of babbitt metals and, as such, the result can contribute to evaluating bearing wear.

Lead

1. Tetraethyl lead is an additive in leaded gasoline. A portion of this normally finds its way into the engine oil.
2. It is a component of babbitt metal, which is used as an overlay on bearings.
3. Many soldering metals contain lead.
4. It is a component in bronze and brass.
5. Certain types of lubricating oil additives contain lead.
6. Some types of sealing gaskets are made with lead.
7. Some types of anti-seize compounds contain lead.

Copper

1. It is frequently an overlay on bearings. It is usually underneath the babbitt and on top of the main body of the bearing shell which is usually steel.
2. It is the main component in bronze and brass.
3. Bushings are frequently made of bronze.
4. Some mechanical parts are copper plated.
5. Cooling coils are often copper tubing.
6. Some oils contain additives made with copper.
7. Gaskets sealants and anti-seize compounds can contain copper.
8. Some mechanical seals are made with copper, bronze or brass.
9. It is a frequent component in Bearing cages, Retainers and Thrust Washers.

Aluminum

1. It is frequently the main component in pistons.
2. Supercharger or Turbocharger blades are often made with aluminum.
3. Some engine blocks contain aluminum.
4. Some bearings are aluminum and aluminum coated.
5. It is a component in clay.
6. Some types of filtering or reclaiming systems use aluminum compounds.

7. Because of its lightweight, many equipment manufacturers use aluminum alloys in gearboxes and other types of housings.
8. It can be found in certain types of greases.

Silicon

1. It is the principal component in dust, sand and dirt. As such, it is very abrasive and causes extra wear.
2. It can be an additive in the oil as a silicone type of compound. As such, it helps lubrication and does not cause extra wear.
3. It is a frequent component of antifoam compounds.
4. Some synthetic oils are silicone base type oil.
5. Some grease is made from silicones.
6. In filter analysis, the acid insoluble portion (after the carbon is removed) can often be considered as silica.
7. It is often an additive in engine coolants.
8. Although often present in steel, it is not used as an indicator of metal wear.

Iron

1. Iron is the main component of steel and depending on other metals or elements, can vary over a very wide range from quite soft and malleable to very hard materials.
2. When reading the iron result, it is very important to see also other metals such as: Chromium, Nickel, Vanadium, Molybdenum, Titanium and Manganese. These metals have a very significant effect on the type of steel that is wearing.
3. Cylinder walls or liners are often a low alloy steel.
4. Some pistons are also made of iron.
5. Engine blocks, differential and transmission housings are often a low alloy steel.
6. Gearboxes are often a low alloy steel.
7. Most often bearing shells are made of steel.
8. Camshafts, crankshafts, gears, valves, rocker arms and cam followers contain steel. Some of these components can be "Case Hardened" or hardened by other metals (mentioned above), silicon and carbon.
9. Rust comes from iron.

Chromium

1. It is one of the metals used to make steels harder. Thus, it can be an indicator of gear wear, ball or roller bearing wear and shaft wear.
2. Many roller or ball bearings contain Chromium along with iron and possibly other metals as well.
3. Very often piston rings are chrome steel or "Chrome faced".
4. Chromium is the main component in chrome plating.
5. Most "Stainless Steels" contain chromium.
6. Sodium Chromate or Potassium Dichromate are very good rust preventatives in cooling systems particularly in systems where water is the only cooling medium.
7. Hexavalent Chromates (Dichromates) in water are not friendly to the environment.

Silver

1. It is sometimes used as a coating on bearings, gears, and bushings.
2. It is sometimes a component of solder.

Zinc

1. It is most often part of an additive in engine oils.
2. It is a component in bronze and brass.
3. It is used in “Cathodic Protection” in circulating water systems.
4. It is used as a corrosion protect agent – galvanization.
5. It is used in solder metals.

Magnesium

1. It can be an additive in oils.
2. It is in so-called hard water; that is ground water or city water.
3. It can be in aluminum or steel alloys.
4. It can be in airborne dust, clay and sand.
5. It can be in gearbox housings.
6. It can be used in Cathodic protection systems.

Nickel

1. It is a metal used to make iron into hard steels.
2. It is found in stainless steels.
3. It can be used as nickel plating.
4. Nickel can be an indicator of shaft wear, gear wear and roller or ball bearing wear.
5. It can be used as an indicator of crude oil contamination.

Sodium

1. It can come from an additive in the oil.
2. It can come from airborne dust of a salty nature or road salt.
3. It is present in many washing compounds and detergents.
4. Many antifreezes have compounds of sodium in their inhibitor (additive) package.
5. It is very rarely used as an indicator of a wear metal.
6. Some grease additives contain sodium compounds.

Barium

1. Some lubricating oil additives contain barium
2. Some types of greases contain barium.
3. It can be found in some types of fuel additives.
4. It is rarely ever used as an indicator of metallic wear.
5. Barium can be found in dust and water.

Calcium

1. Some lubricating oil additives contain calcium.
2. Some types of greases contain calcium.
3. Airborne dust and dirt frequently contain calcium (especially cement dust).
4. It is compounds of calcium that make pure water the so-called "hard water".
5. It is very rarely ever used as an indicator of metal wear.
6. Calcium salts can be used as road salt.

Vanadium

1. It can be found in certain types of hard steels.
2. It is a good indicator of contamination from crude oil.
3. Residual Fuels (Bunker Fuel) usually contain vanadium, thus it will be frequently found in the ash from this type of fuel.

Phosphorous

1. It is often a component in lubricating oil additives. In engine oils, it can be part of the detergent-dispersant-anti wear additive package. In gear oils, it can be part of the E.P. (extreme pressure) additive package.
2. It can be found in grease additives.
3. It is often part of the additive package in antifreezes.
4. Although it is often found in steel, it is not used as an indicator of metal wear.
5. Dust and dirt of clay can contain phosphates.
6. Many types of detergents contain phosphates.
7. Some types of phosphates are in fertilizers.

Molybdenum

1. It is a metal used to make steels harder; some steels containing molybdenum are especially resistant to corrosion.
2. It is sometimes used in piston rings.
3. It is a component of some lubricating oil and grease additives.

Boron

1. It is found in some types of lubricating oil additives; both engine oil and gear oils.
2. It is part of the additive or inhibitor package in most antifreezes.
3. It can be found in water and dirt.
4. Some types of washing detergents contain boron.

Manganese

1. Some types of steel contain manganese.
2. Compounds of manganese can be used as a sacrificial coating to aid the wear in of new equipment.
3. It can be found, as part of an additive used in unleaded gasoline part of this will go into the engine oil.

In view of the ever changing and improving technology of lubricants, metallurgy and coolants, this can only be a partial list. Should there be cases where the source of an element is doubtful, most often consultation with the manufacturer will provide the answer.

Summarizing then, here are the elements according to wear metal, additive or contamination. Note that some of them fit into more than one category.

Wear Metals

Tin, Lead, Copper, Aluminum, Iron, Chromium, Silver, Nickel, Vanadium, Molybdenum and Manganese. When required, we also test for Beryllium, Titanium and Cadmium.

Oil Additives

Lead, Copper, Silicon (as silicones), Zinc, Molybdenum, Magnesium, Barium, Sodium, Calcium, Phosphorous and Boron.

Antifreeze Additives

Silicon, Chromium, Sodium, Phosphorous, Boron and Potassium.

Contaminants

Aluminum, Silicon (silica), Magnesium, Nickel, Sodium, Calcium, Vanadium, Phosphorous, Boron and Potassium.