Technical Bulletin

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Metalworking Fluid Failure Mechanisms — Tramp Oil

Tramp Oil is the name given to oil that gets into metalworking fluids unintentionally. These tramp oils are one of the major killers of metalworking fluids because of how they chemically change the fluids and how they affect the ability to accurately measure concentration.

Tramp oil comes into the metalworking fluid system from a variety of sources, including:

- Machine lubricating oil from hydraulics, way lube, spindles, and transmissions, etc.
- Environmental introduction, e.g., an oil spill or oil washed into the system when the floors or the machines are cleaned.
- Oil carried into the cutting zone on parts from earlier operations running cutting oil or in the form of rust preventative (a particularly nasty form of tramp oil).

There are three different states metalworking fluids.

- "Free" tramp oil or tramp oil that is free floating on the surface of the system as it exists at the time, either in circulation or quiescent (shut down and quiet).
- Dispersed or tramp oil that is mechanically spread throughout the system. Given a long enough time this material will separate and typically rise to the surface.
- Emulsified tramp oil is oil that has become dispersed in the fluid in such a manner that the dispersion (emulsion) is stable over an extended period of time.

Tramp oils are major contributors to these and other problems:

- Residues on machine tools parts and the working environment
- Smoke and oil mist in shop atmospheres
- Impedes filtration
- Stimulates the growth of bacteria and odor
- Reduction of product wetting that contributes to corrosion problems on both parts and chips
- Reduces the ability of the fluid to carry away heat
- Foam from the detergents in some of the oils
- Dermatitis from oils containing active sulfur and/or ZDP
- Increased difficulty in controlling concentration
- Causes a loss of wetting and thereby degrades the workpiece surface finish and tool life

These adverse effects are proportional to the amount of tramp oil present and therefore are most pronounced on those machines which leak the most oil.

As bad as these effects are on individual sump machines, they are even worse in central systems where reduced carryoff allows tramp oils to build up. In addition, continuous recirculation through powerful pumps keeps the oil dispersed and/or emulsified.

In general, we find that there are very few observable or quantifiable problems at tramp oil levels of less than 2%. Above 2% we begin to see increased bacterial activity and above 4%, tool life, finish, oil mist, and residues become more of a problem. The source of the tramp oil can change these percentages substantially, as little as 0.5% of a wax based rust preventative can cause severe problems.

In conclusion, less tramp oil is better than more tramp oil. Tramp oil contamination should be kept as low as possible and removed from the system as quickly and completely as possible.

NOTES:

1. Information on selecting greases and lubricants that create the fewest problems and tools and techniques to remove tramp oil are available in other bulletins in this series.

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