Technical Bulletin

Master Fluid SOLUTIONS

Health, Safety and Environmental Affairs – Nitrites in Rust Inhibitors and Washing Compounds

For many years, (until 1976-77) simple, low-cost materials known as sodium nitrite (N_aNO_2) or potassium nitrite (KNO_2) were used extensively and with great effect in metalworking fluids as ferrous rust inhibitors. This use included grinding and cutting fluids, as well as cleaners and rust inhibitors.

In October 1976 NIOSH (National Institute for Occupational Safety and Health) published a bulletin[1] warning that the presence of nitrosamines had been confirmed in several commercial metalworking fluids. According to that NIOSH bulletin, "...nitrosamines have been regarded as one of the most potent families of animal carcinogens..."

This bulletin set off a storm of additional research [2, 3, 4, 5, 6] with the end result being that all major producers of metalworking fluids, cleaners, and rust inhibitors stopped producing products containing combinations of sodium nitrite and amines. In addition, in rare cases where nitrites were still in use, most manufacturers carefully warned customers to avoid any situation where amines could be combined with nitrites in process.

As a result of all this action, and because most amines and nitrites, by themselves, are safe to use, the Federal Government (U.S.) elected not to legislate against the use of either product when used alone.

However, the use of nitrites in combination with amines in metalworking fluids is regulated by the U.S. Federal Government under 40CFR721.4740[7]. The language of this regulation is specific to metalworking fluids – so cleaners and rust inhibitors are not covered – even though their use and worker exposure may be similar.

Since that time, amines, particularly triethanolamine (TEA) and monoethanolamine (MEA) have remained basic building blocks of metalworking fluids, washing compounds, and rust inhibitors. Another class of amines known as "secondary amines" (primarily diethanolamine or DEA) are seldom used in these formulations in part because most secondary amines are capable of forming nitrosamines by combining with nitrogen from the atmosphere.

Alkali metal nitrites (which include sodium nitrite, potassium nitrite, and others) have largely disappeared from use in cutting and grinding fluids, but some suppliers continue to use nitrites in cleaners or rust inhibitors. Master Fluid Solutions advises that nitrite containing fluids should never be used in any situation where amines could come into contact with them. This would include amines carried into wash or RP tanks in the form of coolant, drawing or stamping compound, or other residues carried on the parts, or any amine containing additive or treatment.

There are two primary defenses that manufacturers of nitrited cleaners or RPs use to assuage customer concerns. One is that only secondary amines (DEA or others) form nitrosamines. The other is that nitrosamines only form at low (acidic) pH. Both of these defenses have been shown to be false.[8, 9]

So take the advice of OSHA[10] and "...to minimize the potential for nitrosamine formation, nitrite-containing materials should not be added to metalworking fluids containing ethanolamines." Or, in our view, the other way around, i.e. amine containing materials should not be allowed to combine with fluids containing nitrites.

References:

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