

A photograph of laboratory glassware, including a graduated cylinder and several Erlenmeyer flasks, containing a yellow liquid. The glassware is arranged in a cluster, with the graduated cylinder on the left and flasks in the center and right. The lighting is bright, highlighting the clarity of the glass and the color of the liquid.

Additives Key to Lube Success

Two Northeastern-U.S. lubricant formulators and one of their metalforming customers explain how new lubricant recipes contribute to improved performance in the press, particularly when deep-drawing difficult-to-form materials and cosmetic parts.

BY BRAD F. KUVIN, EDITOR

By introducing performance additives into the mix, metalforming-lubrication suppliers create formulations that, besides reducing friction and preventing tooling and part material from sticking together, strive to maximize lubricant service life. According to Joe Purnhagen, global commercial manager of metal processing additives for the Lubrizol Corp., Wickliffe, OH, oil-based metalforming lubricants have long-excelled at providing good service life and minimal maintenance requirements. In these fluid types, lubricant formulators are primarily concerned with additive solubility in the base oil, and achieving the right balance of different additives to meet the performance requirements of the given application.

Conversely, says Purnhagen, water-based (emulsion) metalforming lubricants present a much greater design challenge. "The presence of water creates an ideal breeding ground for microbes, and control of corrosion is more difficult in a water-based system," Purnhagen says. "Performance additives used in metalforming lubricants include lubricity enhancers, extreme-pressure (anti-weld or sticking) agents, corrosion inhibitors, emulsifiers and biocides. Achieving long service life from water-based metalforming lubricants is not as simple as the introduction

of a single 'silver bullet' type of additive, but a result of careful consideration of the entire performance additive system and the interaction between the various components. The additives that deliver the primary functions of the fluid for the forming operation—lubrication and corrosion protection—will cease to perform properly if the overall system in which they are delivered becomes unstable."

Emulsifier additives are the key components that allow for a lubricant to mix with water, and retain a stable mixture over an extended period of service. Various types of emulsifier additives are used in soluble-oil (milky appearance) and semi-synthetic (translucent appearance) metalforming-fluid formulations.

"These additives provide the ability to create stable emulsion of materials that are inherently insoluble in water," says Purnhagen, "such as petroleum oils, esters, vegetable oils and synthetic base stocks. In modern lubricant formulations, a carefully balanced ratio of several different emulsifier chemistries is used to achieve the ideal performance for a particular application. The emulsifier system must be durable enough to maintain consistency through the demanding service conditions in a stamping press, including high pressure and introduction of metallic content

to the emulsion. In addition to their emulsifying properties, these additives can contribute supplemental corrosion inhibition and lubricity to the finished metalforming fluid, offering lubricant formulators tools that provide multiple functions simultaneously. Newer product developments in emulsifier composition include a focus on achieving multifunctional performance and reducing the emulsion foaming tendency.”

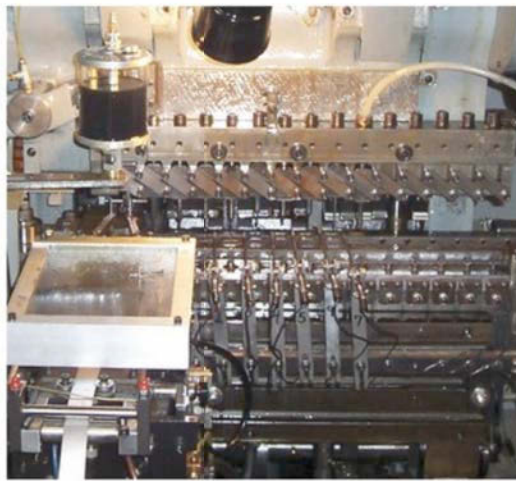
The uncontrolled growth of microbes (bacteria or fungi) is one of the most common sources of emulsion degradation and reduced fluid-service life. Water-based metalforming-fluid emulsions contain an ideal breeding ground for microbes to thrive: water, organic food sources from oils and other performance chemistries, and typically a slightly elevated temperature from the service conditions. To keep microbial growth in check, lubricant suppliers introduce biocidal additives to the recipe, either as a fluid concentrate or as supplemental tank-side additions.

“When applied properly, including biocide product selection and consideration of the correct treat-rate concentration, biocides will effectively control the growth of microbes and promote a longer fluid service life,” says Purnhagen. “All biocidal products are not equal, and the selection process must include knowledge of the compatibility with the overall lubricant formulation. For emulsions, biocides with solubility properties in oil and water can show superior long-term stability and deliver the best overall performance profile.”

Suppliers of quality metalforming fluids generally include some degree of service or training so that biocides are used safely and effectively with their particular products. The results of uncontrolled microbial growth can include product performance degradation, emulsion instability, loss of corrosion protection, foul odors and irritation or illness for shop-floor workers.

Success in the Field

To learn how lubricant formulators are developing new recipes using additives from Lubrizol and other suppliers,



Carby Corp., Watertown, CT, a deep-draw stamper operating some 70 Waterbury Farrel and U.S. Baird transfer presses, used to blend its own lubricants, but as suppliers of compounds started to discontinue some of their ingredients, the stamper looked to outsource lubricant formulation. One particularly challenging job Carby runs: severe deep-drawing of cosmetic brass parts, for ink pens.

we spoke with two Northeastern-U.S. companies that formulate and blend lubricants, coolants and cleaning compounds for metalformers, machine shops and others: Harry Miller Corp., Philadelphia, PA, and Angler Industries, Sterling, CT. Top of mind: recent EPA scrutiny of short-chain chlorinated paraffins, popular additives in metalforming lubricants.

“Additive suppliers have been making concerted efforts to develop replacement additives for chlorinated compounds,” says Nick Ariano, technical director at Harry Miller, “and we’ve had success in several cases for metal stampers formulating lubricants with these new additive packages.”

Describing such successes, Ariano explains how one customer recently replaced a chlorinated lubricant with a nonchlorinated product in a wire-shaving application performed to remove the outer layer of scale. And in another case, dating back to 2008, this one a Pennsylvania metal stamper forming heat-exchanger parts “with a lot of dimples and cup-shaped forms,” Ariano says, “a nonchlorinated lubricant replaced a chlorinated product and the company has had a great track record with the lubricant ever since. Payback for the new lubricant came quickly thanks to reduced waste-disposal costs, with no loss in performance.”

Severe Deep Drawing Still Requires Chlorinated Additives

While these two success stories make a great case for the metalforming industry’s efforts to become more environmentally sound, the job is far from complete. Tony Kroker, a regional manager for Harry Miller Corp., explains:

“In simpler stamping applications, we can readily substitute for chlorinated paraffins (with ingredients such as sulphurized compounds, synthetic esters and calcium sulfonate), with great success. But in more challenging applications, such as deep drawing, compounded by the growing use of tougher materials such as stainless steels and cosmetic brasses, we’ve developed water-soluble draw lubricants that actually have an increased concentration of chlorinated paraffins. In these applications, we find that while we’re not able to eliminate chlorinated products from the lubricants, we are able to switch metalformers over from straight oils to a water-soluble product and provide a more cost-effective product that’s more environmentally sound and allows for easier cleaning. And, since the lubricant contains water, in many cases the presses can run faster.”

Adds Ariano: “In these severe cases (as described by Kroker), the issue is not so much lubricity or the ability to draw the materials. The hurdle with nonchlorinated lubricants, so far, has been stickiness of the stamped parts after forming, as metalformers look to conduct post-forming tasks—stacking and destacking, assembly and the like.”

“Replacing chlorinated paraffins in severe draw applications is an ongoing project,” shares Harry Miller president Bruce Entwisle, “and the technology has a long way to go to allow formulators to deliver effective and affordable lubricants. But I see the time coming—there’s a lot of research and development work going on.”

Angler’s Bob Bristol, vice president of operations, agrees. “Additive suppliers are developing new, useful products

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on a regular basis, to improve oxidation stability, corrosion stability and staining characteristics, among other benefits," he says. "We've even found success in certain deep-drawing applications on cold-rolled steel using a new nonchlorinated water-soluble lubricant."

Drawing Cosmetic Brass Parts

Both Harry Miller and Angler supply custom-blended lubricants, as well as

cleaning compounds, to metalformer Carby Corp., Watertown, CT, a deep-draw stamper operating some 70 Waterbury Farrel and U.S. Baird transfer presses, rated to 75-ton capacity. Up until 2005, Carby blended its own lubricants, but as suppliers of compounds started to discontinue some of their ingredients, the stamper looked to outsource lubricant formulation.

Among the products Carby now

receives from Harry Miller is Hamilube 9900-C, a combination of oils, EP additives (chlorinated paraffins) and emulsifiers that allows Carby to severely deep-draw brass parts (90-10 and 70-30) to a strict cosmetic-finish specification. Draw ratios can exceed 30:1 on parts the company stamps for medical devices, writing instruments, electronic products and other applications.

Carby technical support manager Gary Coviello describes one particularly challenging job—deep-drawing brass parts for ink pens. "We used to run these parts using a water-based lubricant that contained lard oil," he says. "It satisfied our cosmetic requirements, but as an organic compound it created problems with sump life, particularly in warm weather. In some cases sump life would be as short as one week. Now, with the new water-soluble lubricant from Harry Miller, sump life typically is several weeks."

Among the products Angler formulates for Carby is a lubricant developed for deep drawing of stainless-steel parts. "Here, chlorinated paraffin in our previous lubricant caused corrosion and staining of the parts," says Coviello. "Angler's lubricant (Accu-Draw 4640) solved those problems."

For his part, Coviello is acutely aware of the EPA's close scrutiny of use of chlorinated paraffins in the metalworking industry, and so he's taking a hard look at "green" compounds. "We've just begun to test vegetable-based products for stamping some of our nickel-silver parts," he says, noting that not only will he evaluate stamping and drawing performance but also must consider sump life, cleanliness and other factors.

"The parts we're looking at have a relatively high draw ratio (30:1) and also require a good surface finish," he says. "We're having problems with the chlorinated paraffin lubricant we're currently using on this application, as it's attacking our tooling—specifically, the binder in the carbide dies. Staining also is an issue, and we're hoping that the vegetable-based lubricant comes to the rescue." **MF**

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