



The Critical Importance of Applied Oil Lubricants in Metal Extruding

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October 19, 2004

“The correct lubricant applied in the proper way is essential to successful metal extrusion. Anything less can have severely negative consequences.”

INCREASED PRODUCTIVITY INCREASES HEAT

Although some pre-applied wire coatings and dry box lubricants are helpful in metal extrusion processes, liquid lubricants applied during forming steps are often critically important in difficult cold forming applications. In the past, light duty machinery lubricants such as gear oils have been adequate to help cool the metal and provide boundary lubrication during the metal's deformation and sliding movements in the dies. However, lubricants need to have better additive systems to cope with the increased heat generated during extrusion of more complex shaped parts formed with higher alloyed steels. This better lubrication requirement has been further intensified by increased production rates made possible because of sophisticated equipment designs and computerized controls. Increased heat produces warning signs that dictate better lubrication is needed. These indicators are metal scoring, hotter parts, die wear, oil oxidation and smoke generation. Of all the signs, smoke is not only the most dramatic but also of major concern because of environmental issues and worker health.

OIL COMPOUNDING

Most machinery applied lubricants used in steel extrusion processes are based on petroleum oil. Petroleum oil by itself will provide hydrodynamic lubrication on a very limited basis because its fluid film and viscosity cannot hold the load bearing forces during extrusion processes. Oil must contain adequate lubrication additives to perform properly. Petroleum oil also provides some cooling if it is adequately flooded on the parts during transfer steps and allowed to cool in the recirculation reservoir. Some oil systems have cooling capabilities that reduce fluid temperature so that the oil's cooling efficiency is maximized. Because of their limitations, petroleum oil products are compounded with boundary and extreme pressure additives. Boundary lubricants provide a chemical cushion between the metal and the die. Depending on the temperature, active extreme pressure additives chemically react with the metal as it deforms to yield special iron compounds that lubricate by shearing on the moving metal surfaces. Typical extreme pressure additives are based on sulfur and chlorine. Table 1 shows temperature ranges of activation for commonly used synthetic extreme pressure compounds. Passive extreme pressure agents or solids may be used to enhance the synergistic lubrication effect.

Chlorinated compounds can promote corrosion and surface pitting especially the longer the time the extruded parts are stored. Chlorinated oil products are often more difficult to clean and chlorinated paraffins are gaining less favor due to environmental concerns and restrictions. There are newer chemistries that can replace chlorinated compounds without these negative consequences.

In many extrusion machines, the internal lubricant for gearing, cams and other moving parts leaks into the flooded or applied extrusion lubricant. This real world situation requires that a single dual purposed lubricant be utilized so that the forming lubricant would not be contaminated and at the same time not harm any non-ferrous components inside the machinery. The viscosity of the dual purpose lubricant must be carefully selected to achieve optimum performance on both sides of the machinery.

During the oil formulating process, lubrication chemists have to carefully select the proper additives and the amount of necessary compounding based on cost effectiveness. Even the choice of base oils is an important factor to produce product stability, oxidation resistance, minimal viscosity fluctuations, and lower smoking characteristics. The sequence of compounding, temperature, and mixing time must be carefully specified to ensure consistency and stability. Lubricant manufacturers should have strict quality control procedures and process controls in accordance with ISO guidelines.

ANALYZING THE SYSTEM

PICO Chemical Corporation carefully analyzes a system to help uncover any improper lubricant selection or application. By asking a series of key questions and, if necessary, on-site observations, **PICO** seeks to determine the root causes of any lubrication related issues. Improper use of lubricants can create special problems such as: excessive foaming, oil oxidation, short oil sump life, bad odors and difficult cleaning of formed parts and machinery. Oil systems of pumps, piping and reservoirs must be examined. Keeping the oil relatively clean by removing solid contamination is an important consideration when analyzing a lubrication system. If filters, centrifuges, cyclones or other separation units are used, the oil must be formulated and stabilized so that additives will not be stripped out. Sometimes equipment alterations can be helpful to improve the lubricant's efficiency. All these issues must be addressed to help steel extrusion producers achieve higher quality parts and better production rates.

PICO'S CONTRIBUTION

PICO has been meeting extrusion industry requirements with **PICOEXTRUD** oil products in a variety of extrusion machines by helping successfully lubricate the forming processes of fasteners and other complex cold formed parts. **PICO** chemists are constantly looking for new ways to bring higher quality products to the marketplace that will solve operational problems caused by the severe heat and temperatures from the steel's deformation and frictional forces. **PICO** constantly examines new synthetic additives to improve oil lubrication performance while keeping costs down to affordable levels.

Laboratory lubrication testing can be valuable as a screening tool to predict field performance. While there are no specific standardized lubrication tests for extrusion lubricants, tests such as Falex Pin and Vee Block, Four Ball and Twist Compression are often used to gather comparative data about formulated oil products. **PICO** also uses specially designed bench methods to check foam generation, oil clarity, ease of cleaning, oil oxidative stability and corrosion protection.

By combining field experience, laboratory data, and analysis of the customer's system, **PICO** offers the best and most cost effective lubrication product choice.

The metal must be cleaned and finished to achieve total customer satisfaction. **PICO** offers aqueous cleaners to help plant personnel process metal parts most efficiently throughout the entire manufacturing process. By knowing and understanding the lubricant compounds, **PICO** is able to formulate and manufacturer cleaners so that they will work most efficiently in customer equipment.

COSTING CONSIDERATIONS

While the price per gallon of petroleum oil based products is an important consideration and is rising with the cost of crude oil and its availability, the negative cost impact of inadequately formulated lubricants can far outweigh buying on price alone. **PICOEXTRUD** oil products are carefully formulated not only to perform with the proper balance of synthetic additives, but also to last for an extended period of time, thus reducing disposal costs and machinery clean out downtime.

SUMMARY

Lubricants can be looked upon as extrusion machinery's "*Life Blood*" and a critically important component for the achievement of maximum process productivity. Chemistry and equipment knowledge play a crucial role in formulating proper products for complex metal forming applications. During the extrusion process, metal, tooling and lubricant must all harmoniously work together to ensure that the resulting parts meet customer requirements. **PICO** Chemical Corporation has the experience, know-how, staff, equipment and facilities to help satisfy customers demanding needs, improve productivity, and save money.

PICO Chemical Corporation is an ISO 9001:2000 registered manufacturer of value-enhanced specialty chemicals and lubricants to clean, condition, lubricate and protect metalworking, metal forming, metal processing and related manufacturing processes since 1976.

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