SKILL BUILDER

STORAGE, PREPARATION AND DOSING OF FORGING FLUID

Overview

In recent years, the Forging industry has been influenced by numerous challenges, including increasing environmental regulations, evolving customer demands, and the need to increase the productivity and efficiency of the whole manufacturing process chain. These challenges drive continuous development and evolution of the process to meet customer requirements such as:

- Near net shape forging
- Increased shape complexity
- High tensile strength
- Lightweight forging
- Environment, Health & Safety requirements (BIT/MIT free, HAP free, etc.)

All while increasing productivity and reducing costs.

A tailored lubrication solution for each specific process and a fundamental increase in the performance of forging fluids are essential to meet these requirements.

Specific requirements and skills are becoming increasingly necessary to address today's customer needs and industry trends. Besides having a tailored product to support the process, forging companies need to be aware of the main important application-related steps, namely: **Storage, Preparation, and Dosing of Forging Fluids**. In this Skill Builder, we discuss the main characteristics of water-based forging fluids. The main elements of formulation for this family of products will be introduced, and important parameters for storage, preparation, and dosing will be discussed.

Water-Based Forging Fluids

According to data published by EUROFORGE in 2018, more than 80% of lubricants used in forging processes belong to the water-based family due to economic and EHS related factors.

We can define two families under this family of products: **Water-based Graphite & Water-based Graphite-Free** (also refer to as "**Synthetic**"). From a technical perspective, both families provide a different level of performance in terms of **lubricity, cooling, release effect, adherence, and covering** properties. The selection of the right product family is related to the requirements of the process and technical availabilities.

Water-Based Forging Fluids Formulation:

Water-based forging fluids are fairly complex solutions. Each formulation is different and provide a completely different level of added value to the process. The product classification indicates if the fluid contains graphite or is graphite-free. The main formulations and their performance characteristics are as follows:

Water-Based Graphite Forging Fluid:

- Water: Water is used as the primary carrier. It carries the graphite and helps regulate the die temperature (thermal regulation)
- Graphite: Graphite is a solid lubricant composed of lamellas that separate under pressure (shear). Graphite can be synthetic or natural
- Binder: Binders have two leading roles: It helps graphite stick onto the surface and, combined with graphite, helps to improve the resistance of the lubricating dry film. There are different types of binder (Silicate, Borate, Phosphate, etc.)
- Additive: Additives are typically used in minimal quantities in the formulation to enhance the product's performance. There are different types of additives (Thickener, Surfactant, Antifoam, Wettability agent, etc.)

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Water-Based Graphite-Free (Synthetic) Forging Fluid:

- Water: Water is a carrier of the organic acid solution, which helps regulate the die temperature (thermal regulation)
- Organic Acid: Each kind of organic acid reacts within a specific temperature range and time to transform into salts. This salty layer provides various lubricity, cooling, release, adhering, and covering properties
- Additive: Additives are typically used in minimal quantities in the formulation to enhance specific performances. There are different types of additives (Thickener, Surfactant, Antifoam, Wettability agent, etc.)

Key Storage Parameters

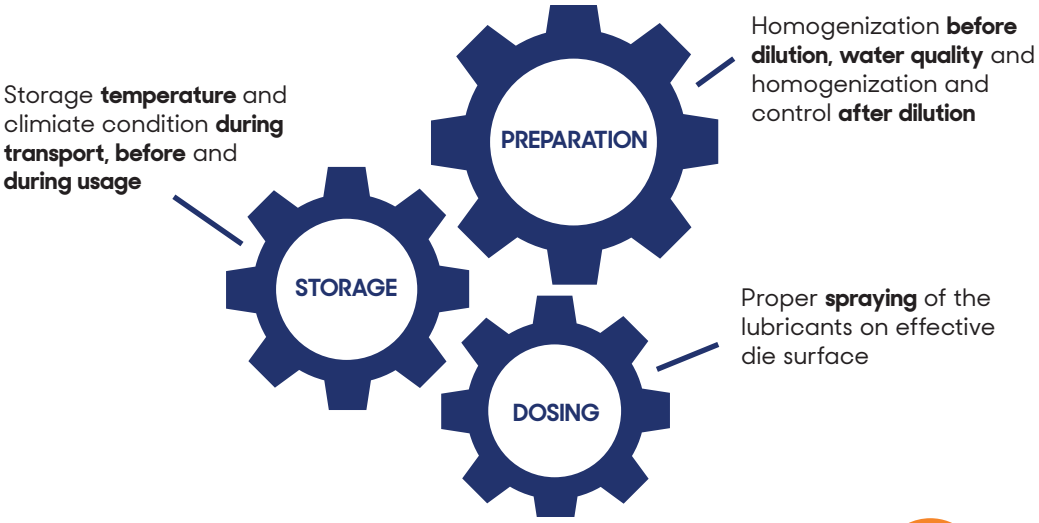
Water-based forging fluids are designed to be stored at a temperature between 5 to 40°C (41°F to 104°F), and the shelf life is typically limited to one year for sealed packaging. Like any water-based product, a temperature below 0°C is not recommended. For graphite fluids, freezing can cause graphite flocculation. In contrast, for graphite-free products, freezing can cause separation of the elements and phase shift, which negatively affects the quality and performance of forging fluid. A high storage temperature will accelerate the graphite sedimentation for the graphited fluids and increase the risk of bacteria development which will affect the performance of all types of water forging fluids.

Key Preparation Parameters

Water-based forging fluids are used in diluted form. Depending on the process and the requirements, the product, mainly in concentrated form, is diluted with water at a given ratio. In order to have a homogeneous product before dosing, it is essential to have proper mixing/stirring while diluting the product. For graphited fluid, it is recommended to stir the product continuously before dilution to ensure that graphite particles are in suspension and distributed homogeneously. In order to have the correct dilution ratio, the concentration can be verified by measuring the dried film. It is also recommended to stir the product continuously in a dedicated tank before spraying on the forging dies to avoid any graphite sedimentation, which negatively affects the fluid performance. For both graphited and synthetic products, it is recommended to stir continuously before dilution. The correct dilution ratio in this family of products can be verified using a Refractometer. The quality of the water used during preparation can affect the forging fluid performances for all water bases. It is essential to be aware of the water quality in the forging plant (ph-value) and discuss with your forging fluid partner before application.

Key Dosing Parameters

Using a proper spraying system is a key parameter for an efficient process. The critical issue is spraying the forging fluid on the effective surface without over-spraying on the other surfaces. The main key elements of a dosing operation are the tailored spraying head, optimum spray pressure, and adjusted spraying time.



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