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Review On Overall Improvement Of Roll Bite Lubricant (Rbl) By Operational

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ABSTRACT

Hot roll lubrication technology in widely used in flat and slope rolling. In flat rolling mills, lubricant in the form of old-in-water emulsion or dispersion is sprayed using flat jet nozzles either inthe roll bite or on the surface of backup rolls. In shape rolling mills, lubricant in the form of emulsionis sprayed directly at the toil bite. The application of roll bite lubrication requires a well-engineered system to prevent the Lubricant from being carried away by the roll cooling water. Each drop of lubricant must be effectively burnt during rolling. The positioning of spray headers inside the mill housing is a critical decision, considering ease of maintenance and system safety.

Keywords: Lubrication, Slipping zones, Strip mill, Nano lubricants.Rolling

1.Introduction

Recent technological developments in hot strip mill processing have increased the attention on RBL (roll bite lubricants). After a brief history of hot steel roll bite lubrication this paper presents thelatest advances in RBL formulation and application. Best practice and case study data are presented including the cost-benefit

analysis of using RBL versus rolling with water alone. Particular focus is given to the interaction between RBL and newer rolling technologies such as high-speed steel rolls and strip chilling. Roll bite lubrication lowers the mill separating force and toques by increasing the slipping zones and counteracting the length of the breaking zone. Bite and roll slippage are no longer factors with the presence of lubrication after oiling time is scheme.

For roll cooling applications of hot steel pure water is normally used as a coolant. The water is usually re-circulated in the plant and should have a sufficient filtration grade in order to prevent clogging of the nozzles. The maximum particle size should not exceed 1/5 of the smallest nozzle internal passage.In many cases roll bite lubrication with pure oil is applied in addition to water, to reduce the rolling loads and the mill vibrations and consequently improve the surface quality of the rolled product. Roll bite lubrication is especially recommended when using HSS rolls having a higher friction coefficient than high chrome rolls.

As cold rolling of steel requires a lubricant in order to fulfil the lubrication role, oil is necessary. Hence,water-oil mixtures are used with a percentage of oil in water of approx. 5%. In most cases emulsions are the common coolants for cold rolling, where the oil and the water form a pseudo- solution. There are stable and meta-stabile emulsions. In other cases, dispersions are used, in which oil and water remain separate and the oil particles are dispersed. In general, dispersions have larger (8-24 um) and more uniform particle sizes and provide a lower iron fine generation. Emulsions have smaller (2-16 pm) and less uniform particle sizes giving a higher level of iron fine generation

The oil separates from the water after hitting the roll surface and plates out to form a thin layer to fulfil its lubrication role. This oil plate-out is very important in obtaining proper lubrication and hence proper strip surface quality. If the rolls run too cold, insufficient oil plate-out may occur andstrip surface suffers.

Like for hot rolling, oil can be applied to the roll gap by so-called direct application. Pure oil is sprayedinto the roll gap just before the bite.

For cold rolling of stainless-steel water-based coolants cannot be used unless the coolant can be completely removed from the strip before it is called, otherwise it produces permanent stains on the surface. For this reason, rolling oil is often used as the coolant/lubricant.

Water is an exceptionally efficient heat transfer medium due to its high density and specific heat capacity. However, its cooling effectiveness is soon reduced by the admixture of, so this effect must be incorporated into the quantity of coolant being utilized 5% of oil in the water may sound negligible,but the heat transfer is compromised Water foil emulsions are, however still about four times more effective in terms of cooling than rolling oil.

The viscosity of the coolant has an influence on the spray developments using nozzles. At higher viscosity, which is normally the case with rolling calls the spray angle reduces compared to using water. These effects must be considered when designing roll cooling arrangements, in order to ensurecorrect spray overlaps.

2.LITERATURE REVIEW

A literature review on roll bite lubrication in the context of metal rolling processes reveals a wealth of information on this critical aspect of industrial manufacturing. Here's a summary of key points and findings from relevant literature:

Roll bite lubrication plays a crucial role in enhancing the efficiency and quality of metal rolling processes. It minimizes friction, reduces energy consumption, and prevents wear on rolls. The types of lubricants commonly used include oils, emulsions, and synthetic lubricants, with the choice depending on factors like the type of metal being rolled and environmental considerations. Various lubrication techniques, such as roll bite lubrication nozzles, are employed for precise application.

Effective roll bite lubrication significantly improves product quality by reducing surface defects and ensuring a smooth finish. It also helps manage heat generation, addressing challenges related to temperature control in rolling mills. Environmental concerns drive the exploration of eco-friendly lubricants and practices, while mathematical modeling aids in optimizing lubrication parameters.

Case studies provide practical insights into implementing roll bite lubrication systems across industries. However, challenges like ensuring uniform lubricant distribution and maintaining lubrication systems persist. Future directions include the development of smart lubrication systems and advances in nano lubricants.

Safety considerations, such as fire hazards associated with certain lubricants, underscore the importance of safety measures in roll bite lubrication practices. Economic analysis highlights the potential cost savings and improved product quality associated with effective lubrication strategies.

- **Importance of Roll Bite Lubrication:**

i. Numerous studies emphasize the pivotal role of roll bite lubrication inenhancing the efficiency and quality of metal rolling processes.

ii. Proper lubrication minimizes friction, reducing energy consumption and wear on rolls.

- **Types of Lubricants:**

i. Literature often discusses various lubricants, including oils, emulsions,and synthetic lubricants, each with its unique benefits and applications.

ii. The choice of lubricant is closely linked to the type of metal being rolled,rolling speed, and environmental factors.

- **Lubrication Techniques:**

i. Research highlights different methods of lubricant application, with roll bitelubrication nozzles being a common choice for precise and controlled application.

ii. The design and engineering of these nozzles are essential for optimizing lubrication.

- **Effects on Product Quality:**

i. Roll bite lubrication significantly impacts the quality of the rolled product. Proper lubrication reduces surface defects and ensures a smooth finish.

- **Temperature Control:**

i. Literature often discusses the challenges of temperature control in rolling mills and how lubrication plays a role in managing heat generation.

- **Friction and Wear Reduction:**

i. Studies show that effective lubrication reduces friction between the rolls and the material, extending the life of expensive rolling mill rolls.

3.Problem Definition

1. Inadequate High-Temperature Performance

   Current lubricants may not perform optimally under high-temperature rolling conditions, leading to increased wear, reduced lubricity, and potential material defects.

2. Environmental Impact

   Conventional lubricants may present environmental challenges, including issues related to disposal, emissions, and sustainability, highlighting the need for more eco-friendly lubrication practices.

3. Lack of In-Depth Tribological Understanding

   The tribological behavior within the roll bite zone is not fully understood at the microscopic level, necessitating detailed analysis using advanced techniques for a comprehensive understanding.

4. Influence on Microstructural Properties

   Limited knowledge exists regarding how lubrication practices affect the microstructure of rolled materials, which is essential for predicting material properties accurately.

5. Suboptimal Application Processes

   The methods used for applying lubricants may not be optimized for efficiency, coverage, or precision, underscoring the importance of exploring advanced and automated application processes for enhanced lubrication.

6. Insufficient Integration of Smart Technologies

   There is often a lack of incorporation of smart lubricant technologies with real-time monitoring and adaptive adjustments, indicating the need to explore these innovations to improve overall lubrication effectiveness.

4.Objectives

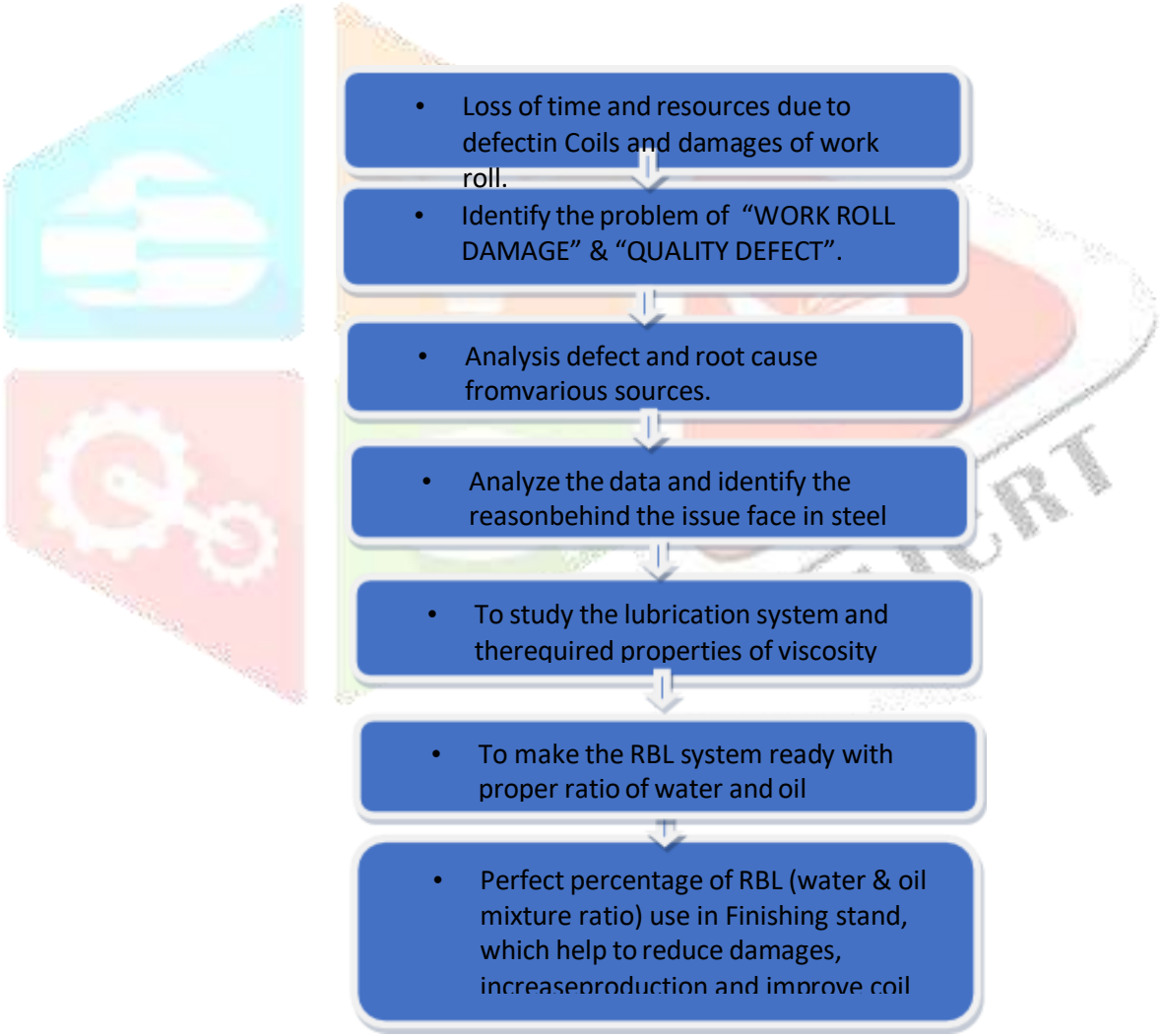
Clearly defined research objectives Specific outcomes expected from the study

i. Lubrication is one of the most critical parameters for hot strip rolling as it impacts the mill stability and the product surface quality.

ii. The full strip lubrication has been always the optimum lubrication mode for roll surface and process models adaptation

iii. But applying RGL since strip head represents a challenge for achieving successful biting especially with thin gauges rolling that's why unlubricated head is always recommended.

5.METHODOLOGY



- **Challenges Faced in Current RBL Practices:**

Challenge	Description
Inadequate High-Temperature Performance	Current lubricants may not exhibit optimal performance in high-temperature rolling conditions,leading to increased wear, reduced lubricity, and potential material defects.
Environmental Impact	Conventional lubricants may pose environmental challenges, including issues related to disposal, emissions, and sustainability. There is a need for more eco-friendly lubrication practices.
Lack of In-Depth Tribological Understanding	The tribological behavior within the roll bite zone remains inadequately understood at the microscopiclevel. Detailed analysis using advanced techniques isnecessary for a comprehensive understanding.
Influence on Microstructural Properties	Limited knowledge exists regarding how lubrication practices affect the microstructure of rolled materials. Understanding these influences is essential for predicting material properties accurately.
Suboptimal Application Processes	The methods employed for applying lubricants may not be optimized for efficiency, coverage, or precision. Exploring advanced and automated application processes is vital for enhanced lubrication.
Insufficient Integration of Smart Technologies	Incorporation of smart lubricant technologies with real-time monitoring and adaptive adjustments is oftenlacking. Exploring these innovations can significantlyimprove overall lubrication effectiveness.

Parameter for material(lubrication) selection.

Selecting the appropriate lubrication for roll bite lubrication in metal rolling processes is essential for achieving optimal results. The choice of lubrication depends on various factors, including the type of rolling mill, the materials being processed, and specific process requirements. Here are some basics toconsider when selecting lubrication for roll bite:

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Viscosity:

- Viscosity is a key factor. It should match the rolling speed and temperature conditions to ensure proper lubrication coverage and effectiveness. High-viscosity lubricants are often used for heavy-duty rolling processes, while low-viscosity ones are suitable for high-speed rolling.

Temperature resistance:

- Rolling mills generate significant heat. The chosen lubricant should be capable of withstanding the high temperatures generated during the rolling process without breaking down or evaporating.

Load-Bearing Capacity:

- Consider the load and pressure applied during rolling. The lubricant should provide sufficient load-bearing capacity to prevent metal-to-metal contact and reduce friction.

Cleanliness:

- Lubricants should be clean and free of contaminants. Contamination can lead to surface defectson the rolled material.

Environmental Considerations:

Depending on local regulations and environmental concerns, you may need to choose lubricants that are environmentally friendly and compliant with relevant standard

Advantages

i. Precise, reliable delivery of lubricant
ii. Battery operation,voltage supply 24V
iii. Delivery pressure max. 7.5 bar (109 psi)
iv. Emptying time 1 - 12 months

Disadvantages

i. Carbon deposits and burning of oil film
ii. Fouling of sparkplug, increases maintenance cost.
iii. Oil consumption is high, rather the engine is usually over oiled

Applications

i. Economical and cheap
ii. No oil pump, filter and oil carrying pipe needed
iii. Quantity of oil is automatically regulated with load and speed
iv. Probability of lubrication failure are the least

CONCLUSION

Kewdol HR-10 S is help in

- Maintaining oil film strength through optimized viscosity and S.V.
- Ensuring oil film formation in high temperature
- Ensuring the reducing roll force caused by the reduction friction coefficient, protecting WR surface with EP performances

As a results of the above effects, it can be possible to improve Work Roll life and Operating stability, productivity in JSW DOLVI Hot strip mill. Roll bite lubrication is a pivotal aspect of metal rolling processes that significantly impacts the efficiency and quality of industrial manufacturing.

1. Enhanced Efficiency: Proper roll bite lubrication reduces friction between the rolls and the material being rolled, leading to increased energy efficiency and reduced wear on expensive rolling mill equipment.

2. Quality Improvement: Effective lubrication results in improved product quality by minimizing surface defects and ensuring a smoother finish on the rolled materials.

3. Material Compatibility: The choice of lubricant is closely tied to the type of metal being rolled and other variables, emphasizing the importance of material compatibility.

4. Precise Application: Roll bite lubrication nozzles offer controlled and precise application, ensuring that the lubricant is distributed evenly across the rolling surface.

5. Temperature Control: Roll bite lubrication helps manage heat generation within rolling mills, addressing the challenge of temperature control in these industrial environments.

6. Environmental Considerations: The literature acknowledges the increasing importance of environmentally friendly lubricants and sustainable practices in response to growing environmental

regulations.

7. Mathematical Modelling and Simulation: Mathematical models are employed to optimize lubrication parameters, contributing to more efficient roll bite lubrication systems.

Future Scope

Present development activities are focused on enhancing the work roll lubrication system for a safe continuous lubrication operation from the very beginning of the strip until the end of the strip. Therefore, at least for limiting strips in terms of the bite angle and the friction coefficient, possible remaining lubrication oil has to be safely removed from the work roll surface before thread in of the next strip. Further, core components are continuously optimized to guarantee that the Primetals advanced work roll lubrication system adds value to our customers' products.

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