CAUSES OF WEAR IN HAMMER CRUSHERS

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Abstract : *Hammer crushers play a crucial role in industries such as mining, construction, and metallurgy by efficiently breaking down hard materials. However, their performance and lifespan are significantly affected by wear and tear, which results from mechanical impact, abrasive forces, erosion, and thermal or corrosive effects. This study examines the primary causes of wear in hammer crushers and explores effective countermeasures to mitigate their deterioration.*

Key words*: Abrasive wear, modified design, mechanical, quartz.*

Introduction

Hammer crushers are widely used in mining, construction, and metallurgy for crushing hard materials. Their efficiency and service life depend on the extent of wear and tear during the crushing process. This thesis discusses the causes of hammer crusher wear and effective countermeasures to mitigate it.

Mechanical wear occurs due to the continuous impact and friction between the hammer and the material being crushed. The following factors contribute to mechanical wear. Hammers strike hard materials at high speeds, causing deformation and gradual material loss. Fatigue wear: Repeated impact cycles create stress fractures in the hammer and crushing chamber, leading to cracks and breakage over time. Sliding wear: When the material moves along the crusher surfaces, it creates friction, gradually eroding metal components. Abrasive wear is caused by the presence of hard particles, such as quartz, silica, or metal fragments, in the feed material. This type of wear occurs in two forms: Two-body abrasion: Hard particles directly scratch and erode the hammer surface. Three-body abrasion: Loose abrasive particles become trapped between the hammer and the material, accelerating wear. High-speed material flow within the crusher chamber can lead to erosion of metal surfaces, especially in areas where turbulence occurs. Additionally, cavitation (formation and collapse of air bubbles due to pressure changes) can cause localized pitting and damage to the hammer and internal

components. During prolonged operation, hammer crushers generate significant heat due to friction and impact forces. This heat can cause softening of metal surfaces. At high temperatures, metal loses hardness, making it more vulnerable to wear. Thermal fatigue: Continuous temperature fluctuations cause expansion and contraction, leading to micro-cracks in the hammer and crusher body. Oxidation and corrosion: Exposure to moisture, acidic gases, or aggressive chemicals accelerates rust formation and weakens structural integrity. Certain materials processed in hammer crushers may contain chemical compounds that react with metal surfaces, leading to corrosion. For example:

Sulfur-containing ores can cause sulfide corrosion. Moisture and acidic compounds can accelerate rust formation. Salt and chloride exposure can lead to pitting corrosion, further reducing hammer strength. Improper operation and maintenance practices can accelerate wear in hammer crushers: Excessive feed size: Large or unprocessed materials cause higher impact forces, increasing wear rates. High operating speed: Increased rotor speed generates greater impact energy but also accelerates wear. Poor lubrication and maintenance: Lack of regular lubrication leads to increased friction and component failure. Uneven material distribution: Unequal feed distribution causes localized wear, shortening the lifespan of hammers and liners. The choice of materials for hammer crushers significantly affects their durability and resistance to wear. Selecting the appropriate materials helps improve the lifespan of hammers, liners, and other critical components. Use of Wear-Resistant Materials High-Manganese Steel (Hadfield Steel, Mn13–Mn18): This is one of the most commonly used materials for hammers due to its work-hardening properties. When subjected to impact and pressure, the surface hardens while maintaining a tough core, making it highly resistant to abrasion.Ideal for crushing medium-hard to hard materials but may wear out faster in highly abrasive environments.

Carbide-Coated Hammers:Tungsten carbide or chromium carbide coatings can significantly enhance resistance against wear.These coatings are applied to the hammer’s striking surface, making them suitable for crushing highly abrasive materials such as quartz, granite, and recycled concrete.Carbide coatings are costlier but provide longer service life compared to traditional steel hammers.

White Cast Iron (High-Chromium Iron, Ni-Hard): Contains a high percentage of chromium (Cr) and nickel (Ni), which provides excellent hardness and wear resistance. Commonly used in applications where hammers experience severe abrasive wear but relatively low impact forces. Brittle in nature and can fracture under extreme impact.

Conclusion

Understanding the causes of wear in hammer crushers is essential for improving their performance and service life. By addressing these factors through proper material

selection, design improvements, and optimized operational practices, industries can reduce maintenance costs and enhance crusher efficiency.

References

1. Jeffus, L. Welding: Principles and Applications. Cengage Learning, 2016.
2. Cary, H. B., & Helzer, S. Modern Welding Technology. Pearson, 2011.
3. American Welding Society. Welding Handbook. AWS, multiple volumes.
4. Jefferson, T. B., & Woods, G. Metals and How to Weld Them. The James F. Lincoln Arc Welding Foundation, 2004.
5. Weman, K. Welding Processes Handbook. Woodhead Publishing, 2011.