ENHANCING EFFICIENCY IN NICKEL ORE PROCESSING THROUGH REDESIGNED CRUSHER TEETH

Nicolev Hidayat

PT Nicko Industri Metal

Bekasi, Jawa Barat

Email: hidayat.nicolev@gmail.com

ABSTRACT

This study aims to evaluate and improve the design of crusher teeth on the Mineral Sizer Crusher used in the nickel ore processing operations at PT X. The primary issue identified was the discrepancy between the actual production capacity and the initial machine design specification, where the production capacity, initially targeted at 500 tons/hour, only achieved 120 tons/hour. Additionally, frequent machine shutdowns occurred due to material accumulation that could not be efficiently crushed. This research involves analyzing the initial design, evaluating the material used, and developing an optimized crusher teeth design using SCMnH11, a material known for its high resistance to impact and abrasion. The results indicate that the redesigned crusher teeth, with optimized geometry and material properties, successfully increased production capacity to 500–550 tons/hour and reduced the risk of machine stoppages caused by material blockages. This study concludes that optimizing the crusher teeth design and selecting appropriate materials can significantly enhance the operational efficiency and reliability of the machine in nickel ore processing.

Keywords: *Mineral Sizer Crusher, Crusher Teeth, Nickel Ore, Redesign, Production Efficiency.*

INTRODUCTION

The importance of nickel ore processing in global industries, such as stainless steel and battery production, necessitates highly efficient and effective machinery [1]. Efficient processing of nickel ore is critical due to its pivotal role in modern technologies. The Mineral Sizer Crusher at PT X, originally failing to meet its production targets with a maximum output of only 120 tons per hour compared to the designed capacity of 500 tons per hour, provided a unique case study for examining the impacts of component redesign in industrial equipment especially crusher teeth.

RESEARCH METHODS

The study followed a systematic engineering design approach combining both quantitative and qualitative methods:

1. Design Requirements Analysis: Characterization of nickel ore properties such as moisture content, hardness, and particle size.
2. Material Selection: Selection of SCMnH11 for its superior wear resistance and impact strength.
3. Design and Simulation: Utilization of CAD tools for designing and simulating the new crusher teeth.

RESULTS AND DISCUSSION

The redesign resulted in a crusher capable of meeting its intended output of 500-550 tons per hour—a significant improvement from the initial 120 tons per hour. This outcome was verified through simulation with operating the crusher machine, confirming the new design's effectiveness.

The study highlights the critical importance of material selection and precision in design to enhance the performance of mineral processing equipment. SCMnH11 was instrumental in achieving the desired durability and functionality under the harsh operational conditions of nickel ore processing compare to existing material, which is SCMnCr2 [2].

Table 1. Chemical Composition of Existing and Optimizing Crushing Teeth

	C	Si	Mn	P	S	Cr
SCMnCr2 ***(Existing)***	0.25 – 0.35	0.30 – 0.60	1.20 – 1.60	0.040 Max	0.040 Max	0.40 – 0.80
SCMnH11 ***(Optimizing)***	0.90 – 1.30	0.80 Max	11.00 – 14.00	0.070 Max	0.040 Max	1.50 – 2.50

The change in design is focused on dimension height of the teeth. As shows in Figure 1 the optimizing design have higher teeth and thinner body.

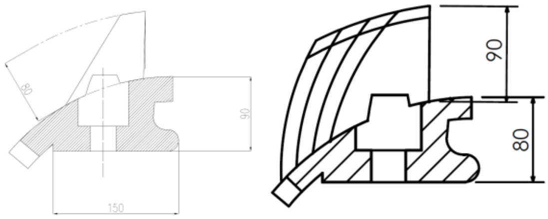

Figure 1. Existing dan Optimizing Teeth Design

The configuration of Teeth changed from 25% Single-Row Tooth Segment and 75% Double-Row Tooth Segment into 100% Single-Row Tooth Segment with the optimizing design. It helps ore crushing time significantly changed faster than before.

CONCLUSION

The study successfully demonstrates that redesigning crusher teeth with appropriate materials and design adjustments can significantly enhance the throughput and reliability of processing equipment. This optimization not only meets the designed capacity but also reduces operational disruptions, setting a benchmark for future enhancements in similar industrial applications.

It also encapsulates a comprehensive examination and solution to the underperformance issues of the Mineral Sizer Crusher at PT X, highlighting significant advancements in material science and mechanical engineering that are applicable to the broader field of mineral processing technology.

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