



Council for Mineral Technology



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metallurgical innovation

An overview of HPGR testwork program at Mintek

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Presentation overview

- Introduction
- HPGR's on site at Mintek
- Key questions on HPGR
- HPGR testwork program
 - Development/ Improvement of test procedures
 - HPGR operation
 - Flowsheets development
 - Modelling and simulations
 - Downstream benefits
 - HPGR control
- Conclusion

Introduction

HPGR is maturing to become a competitive technology in designing comminution circuits

Motivation to implement a HPGR

- Improve Energy efficiency
- Cost reduction by not using grinding media
- Debottlenecking
- Metallurgical performance
- Differential comminution

HPGR's on site at Mintek

1. Polysius HPGR



Studded rolls



Diameter=0.250 m
Width=0.100 m
Top size: 12 mm



HPGR's on site at Mintek

2. Koppern HPGR

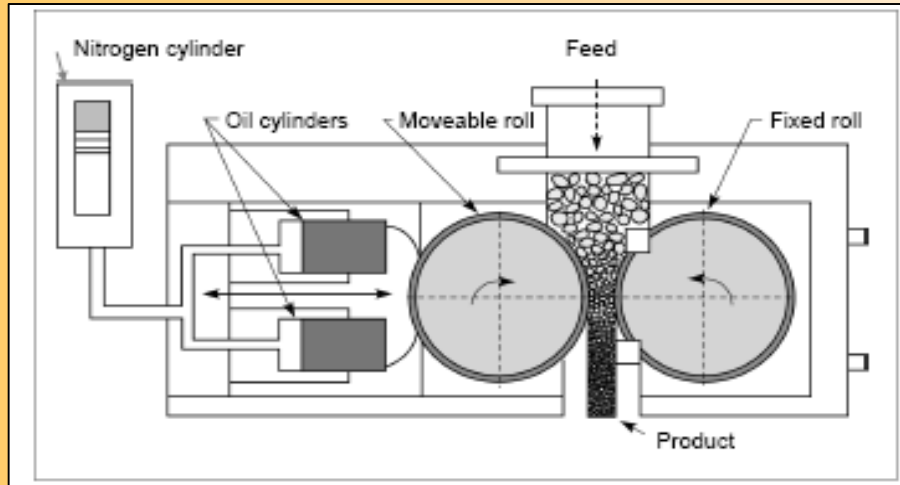


Hexadur Rolls

**Diameter= 1 m
Width= 0.250m
Top size: 40 mm**



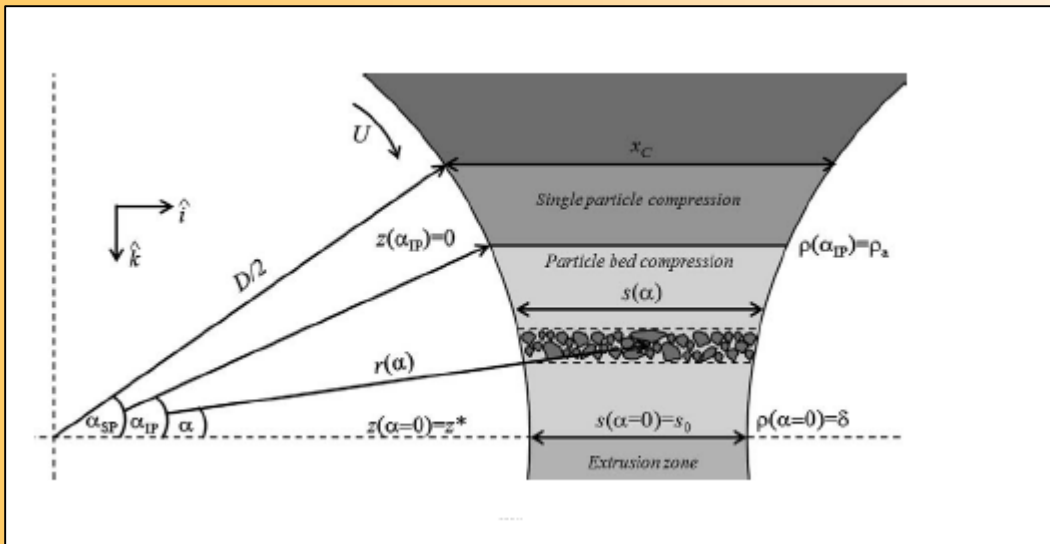
Crushing in a HPGR



Feed

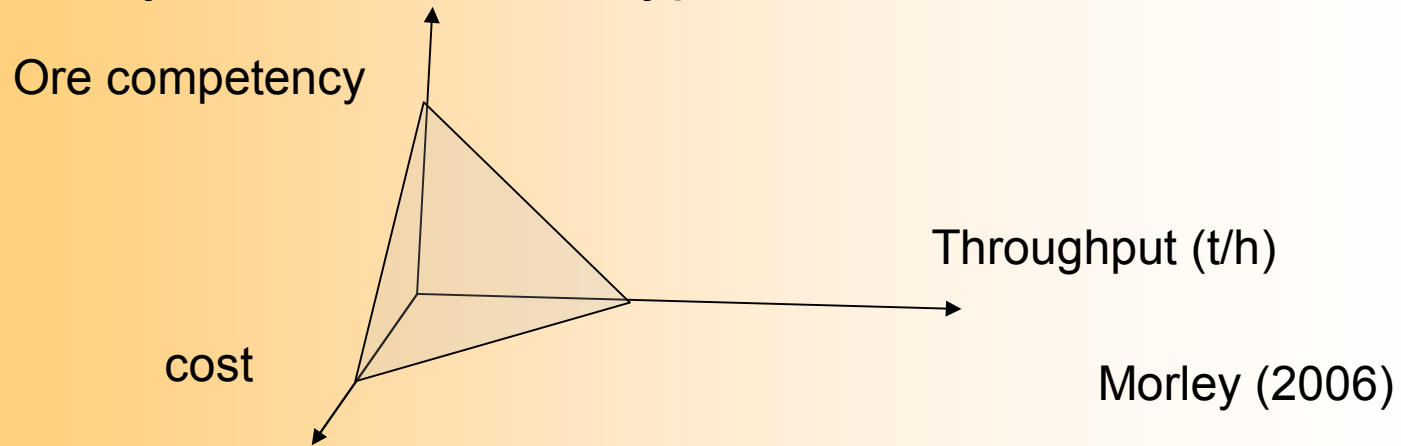


Product



Key questions

- Amenability of different ore type to HPGR?



Does an open circuit HPGR do a better job than a modern closed circuit cone crusher for tertiary crushing duties?

- Testing
- Quantification of HPGR benefits

Does HPGR technology provide lower energy and steel consumption?

Does HPGR technology lead to better concentrate circuit grades and recoveries?

Does HPGR technology lead to better kinetic of flotation or leaching?

- Limitations of the technology

HPGR testwork program

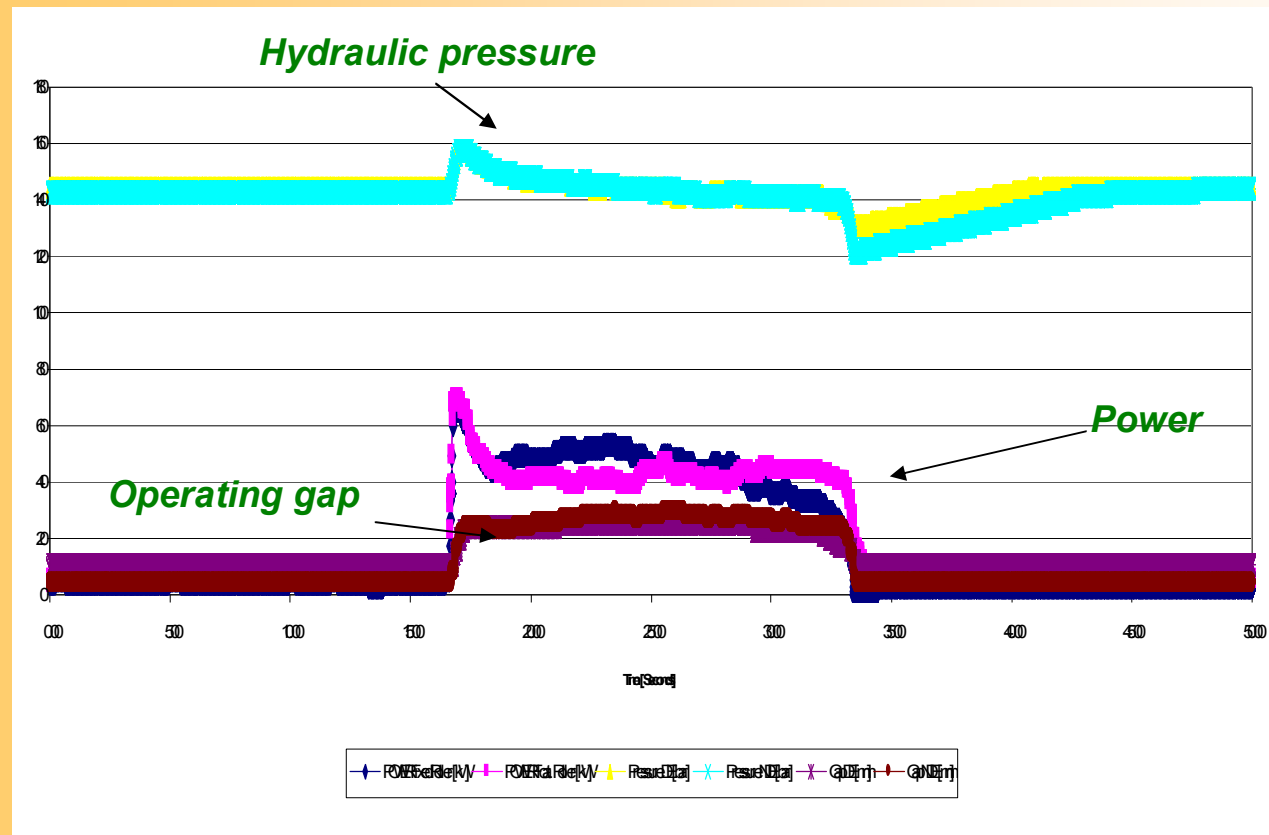
1. Testing: ore amenability

1. Improved method for testing
 - ✓ Amount of sample to be used
 - ✓ Data recording
 - ✓ Sampling
2. Development of a flake competency index to characterise the competency of HPGR flakes
3. Piston die compression test to predict HPGR performance
4. Wear tests

HPGR testwork program

I. Ore amenability

1. Influence of operating variables



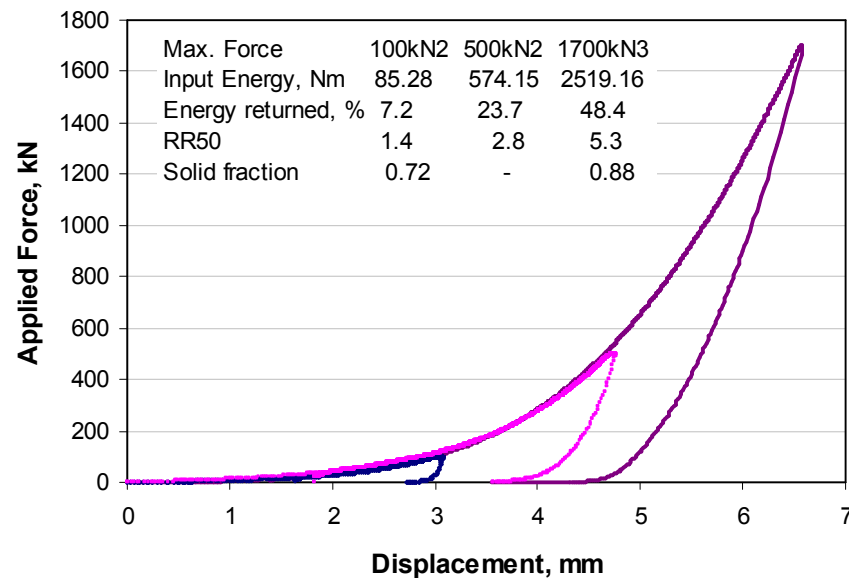
Typical HPGR test output

HPGR testwork program

I. Ore amenability

2. Piston die compression test

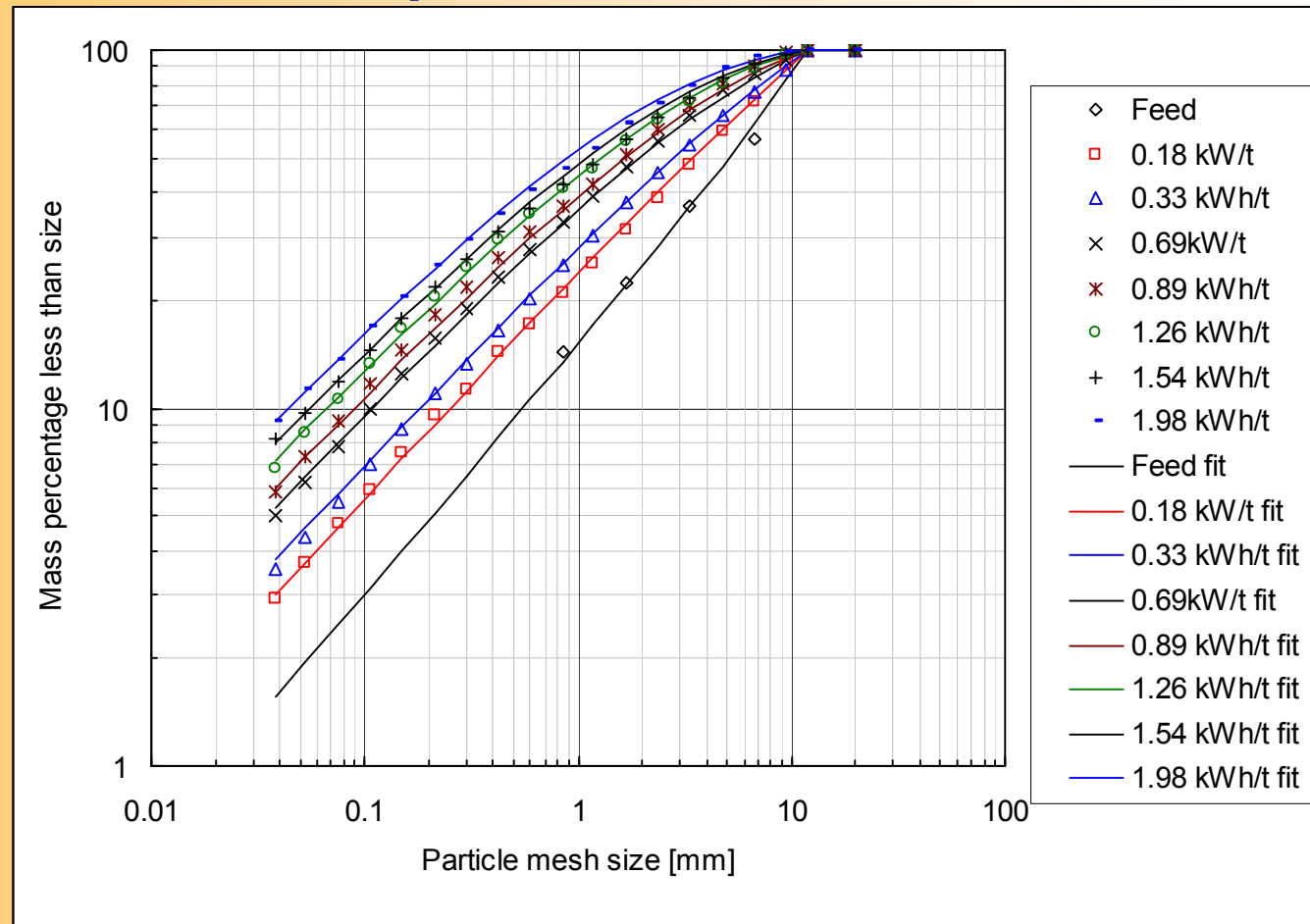
263g UG2 -12mm, compression at different forces



HPGR testwork program

I. Ore amenability

2. Piston die compression test



Merensky ore: top size 12 mm

HPGR testwork program

I. Ore amenability

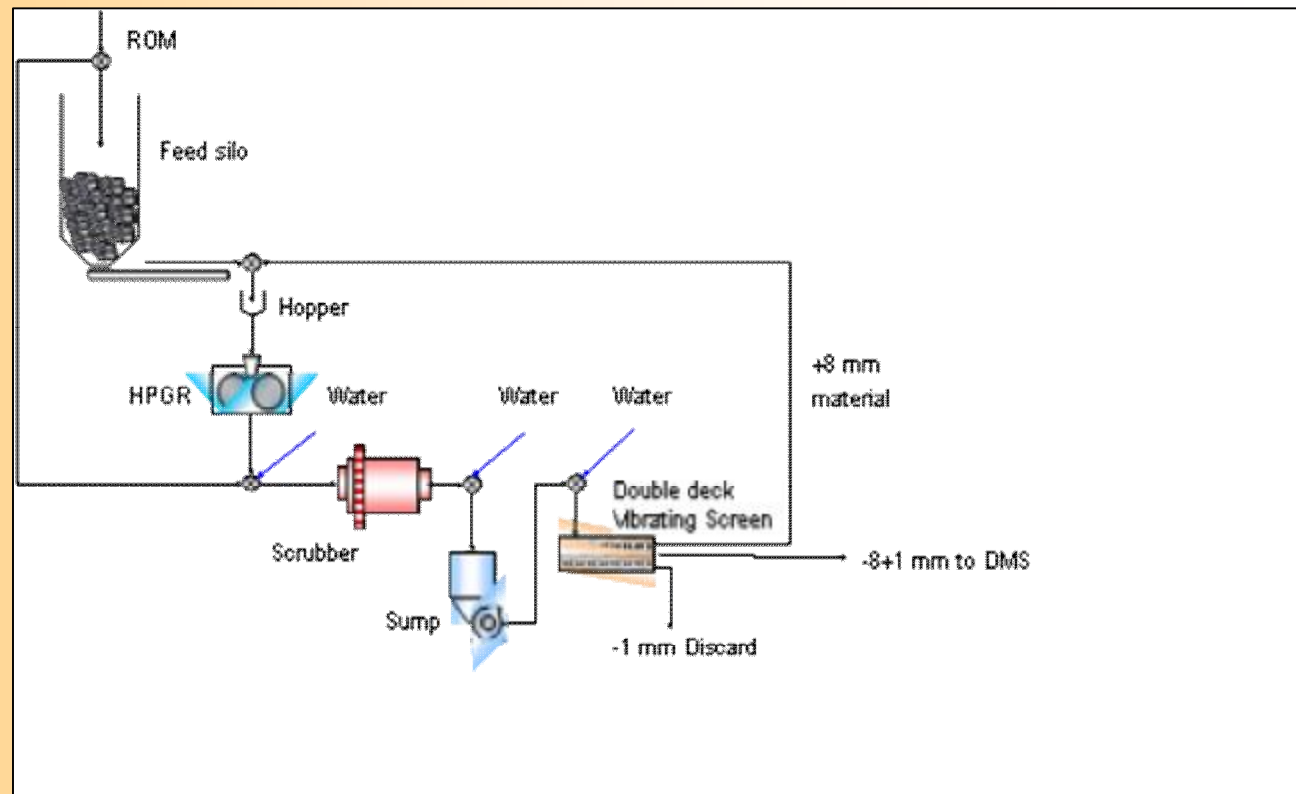
3. Development of a “ Mintek ” flake competency test

Merensky ore flake



Kimberlite flake after deagglomeration in a scrubber

HPGR flake deagglomeration using a scrubber: Kimberlite ore

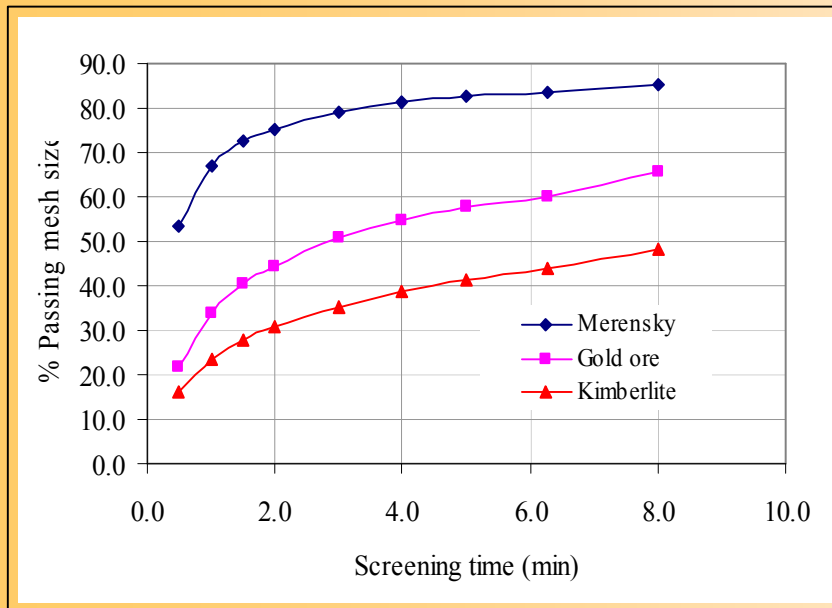


Circuit used at Jwaneng

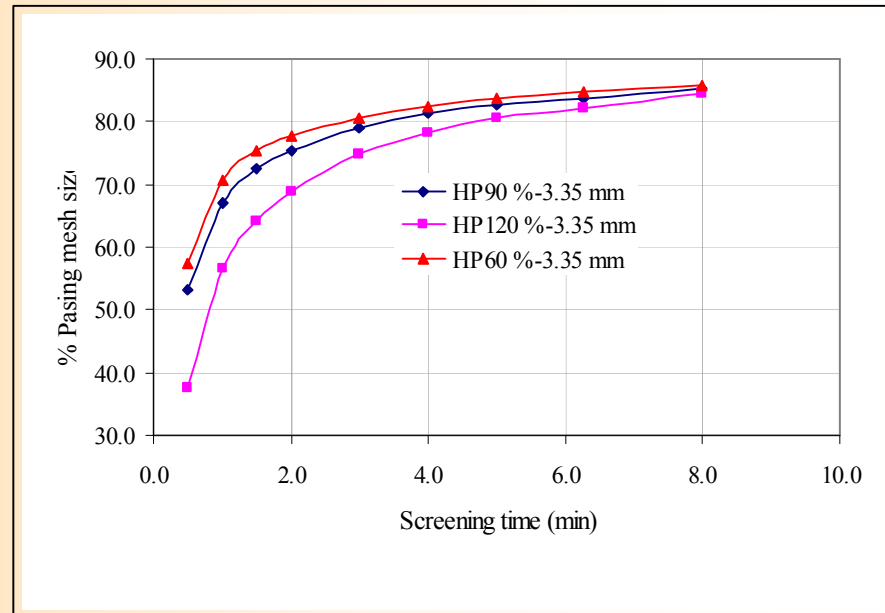
HPGR testwork program

I. Ore amenability

3. Development of a “Mintek” flake competency test



Influence of ore type on screening kinetic

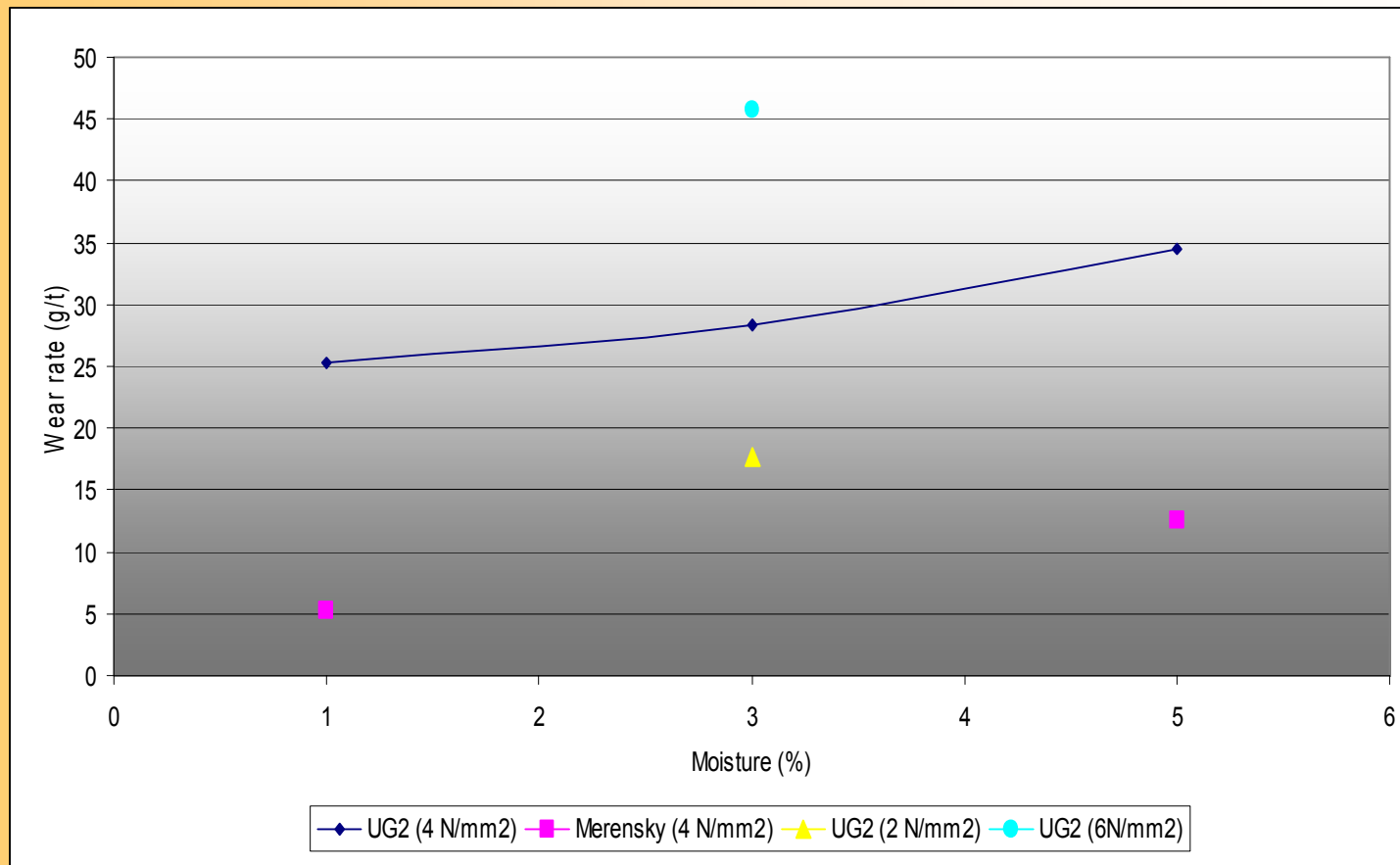


Influence of hydraulic pressure on screening kinetic for a Merensky ore

HPGR testwork program

I. Ore amenability

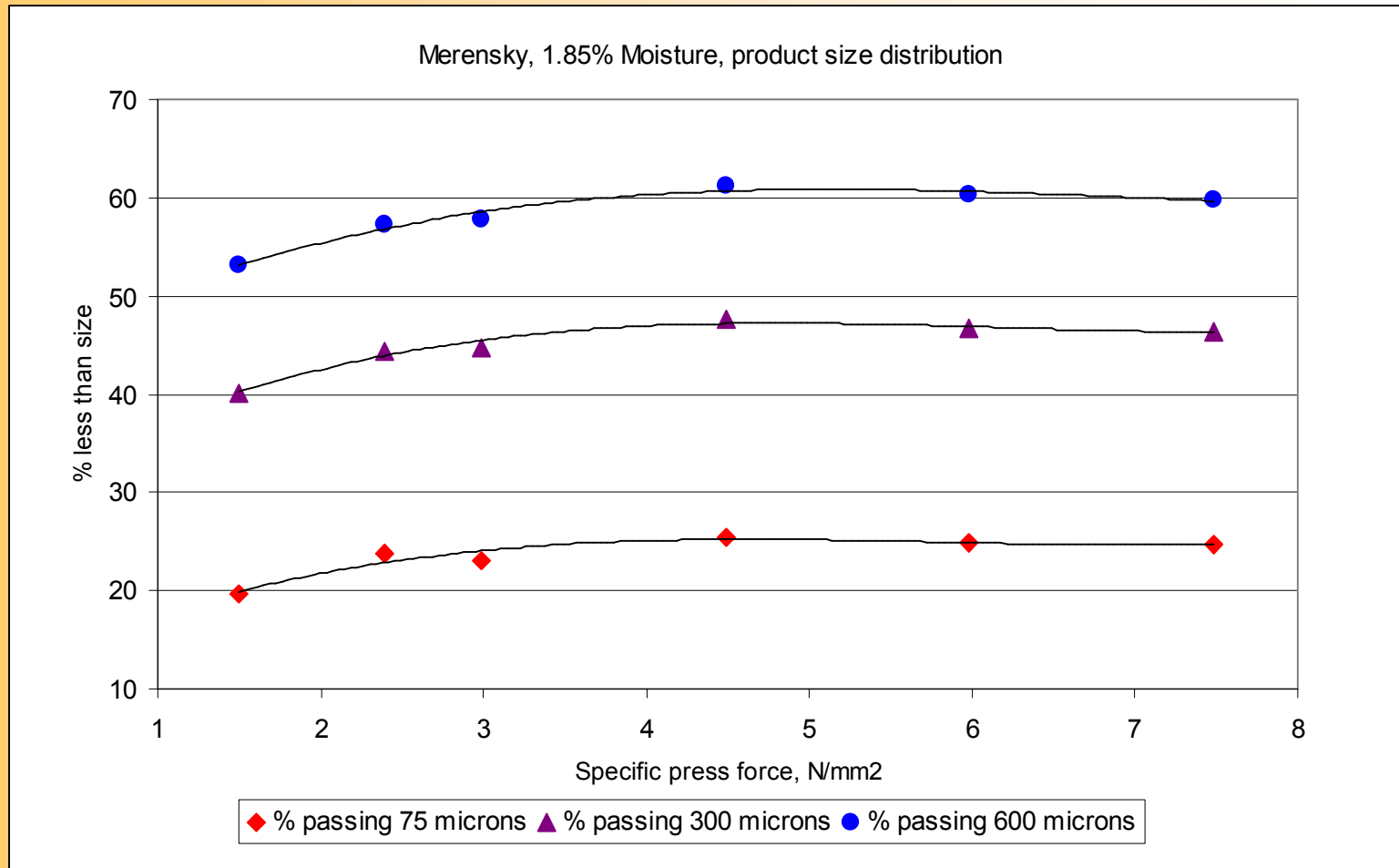
4. Wear test



UG2 and Merensky results on Polysius studed rolls

HPGR testwork program

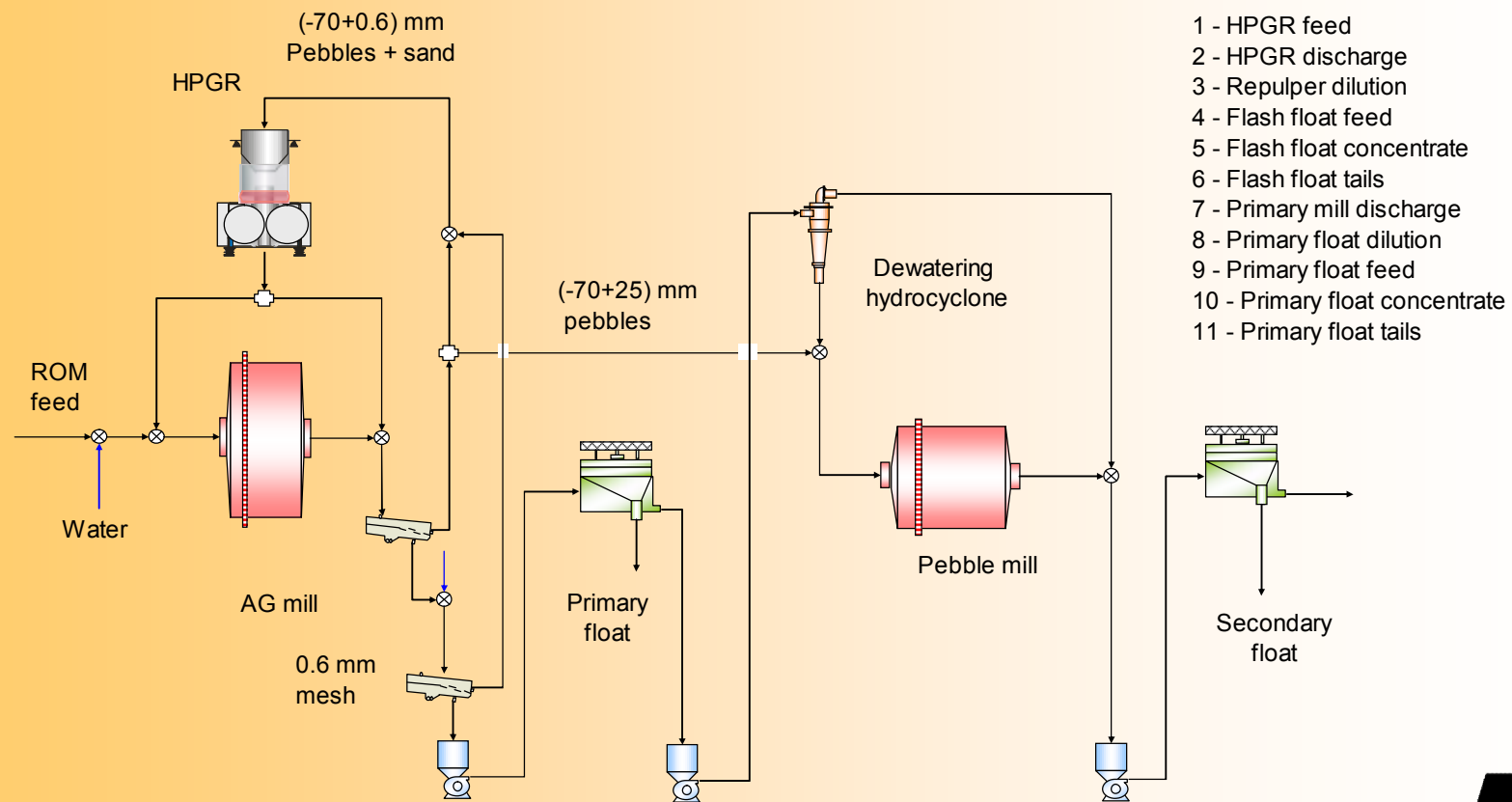
II. Influence of operating conditions



HPGR testwork program

III. Flowsheet development

Comminution circuit without using steel as grinding media

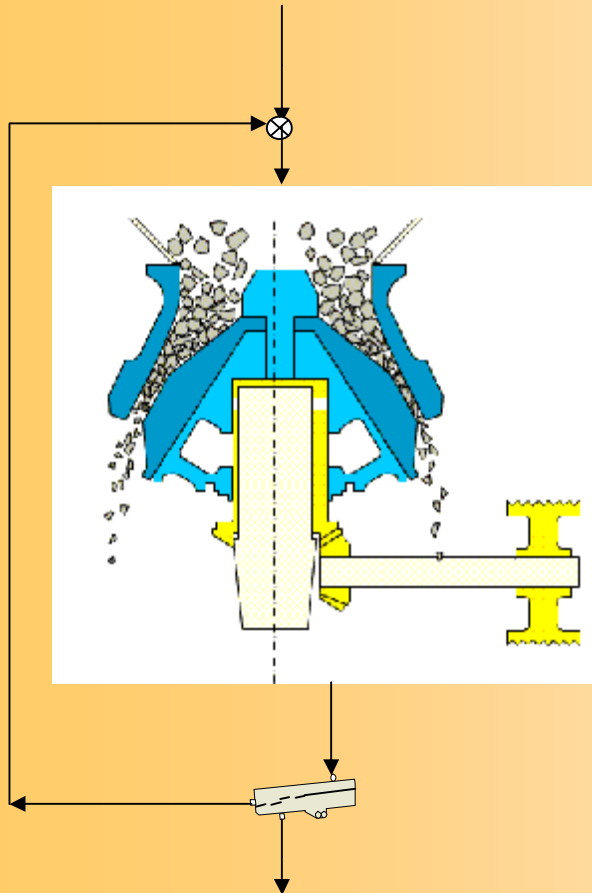


HPGR testwork program

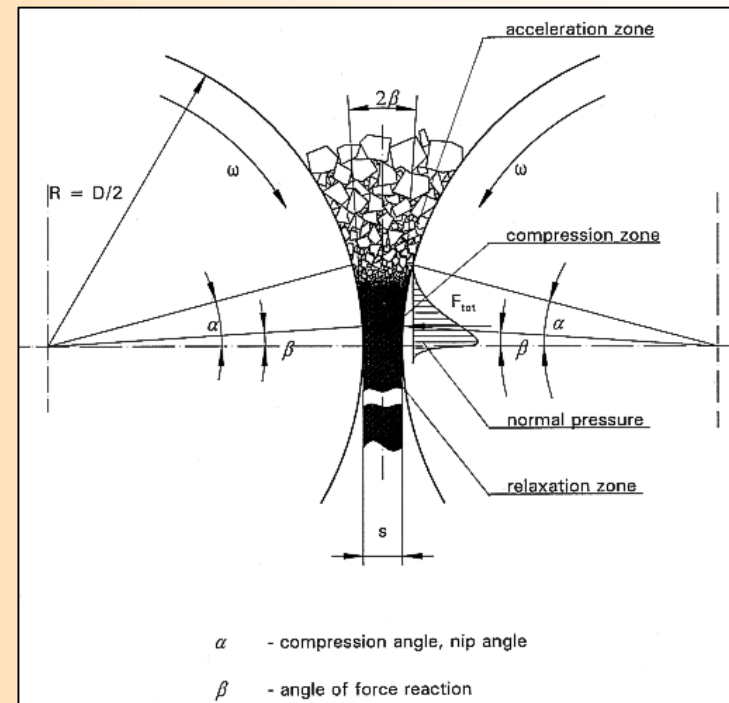
III. Flowsheet development

- Assessing HPGR benefits as a tertiary crusher in comparison to modern cone crusher choke fed

Action in a cone crusher



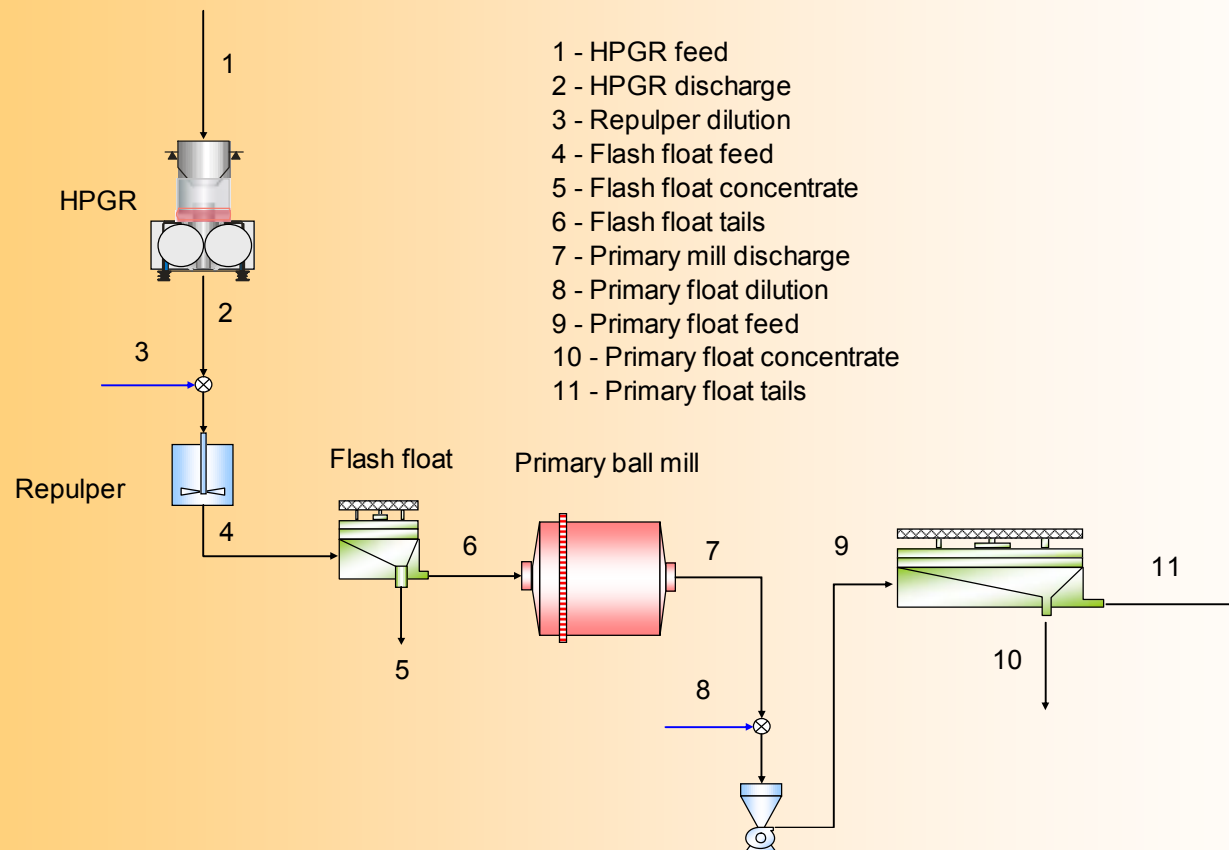
Action in a HPGR



HPGR testwork program

III. Flowsheet development

- Assessing HPGR benefits as a tertiary crusher in comparison to modern cone crusher choke fed



Basic Northam circuit

HPGR testwork program

IV. Modelling, simulation and scale up

Objectives:

- Development of steady state and dynamic model for HPGR
- Scale-up from HPGR laboratory test and compression tests
- Plant surveys

HPGR testwork program

V. Downstream benefits

Objectives: Quantification of HPGR downstream benefits

- Milling
 - Reduction of spec. energy consumption
 - Reduction of BBWI
- Flotation and leaching
 - Faster kinetic
 - Better recovery
- Mineralogy
 - Liberation
 - Quantification of microcracks

HPGR testwork program

VI. HPGR control

Objectives: Improve HPGR performance by providing better control

- Maintain throughput by changing roll speed
- Maintain or avoid cake formation
- Control the quality of HPGR product by changing on line the split between edge and centre product
- Maintain an autogenous layer on HPGR to minimize wear

Conclusion

Current limitations of the technology:

- Feed top size (~ 80 mm)
- Feed moisture
- Product size distribution
- Classification of HPGR product
- Capacity
- Wear rate

The future of the HPGR depends on progress made to improve the current understanding of the technology and on our ability to exploit all benefits provided.

Acknowledgements

- Mintek
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Thank you



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