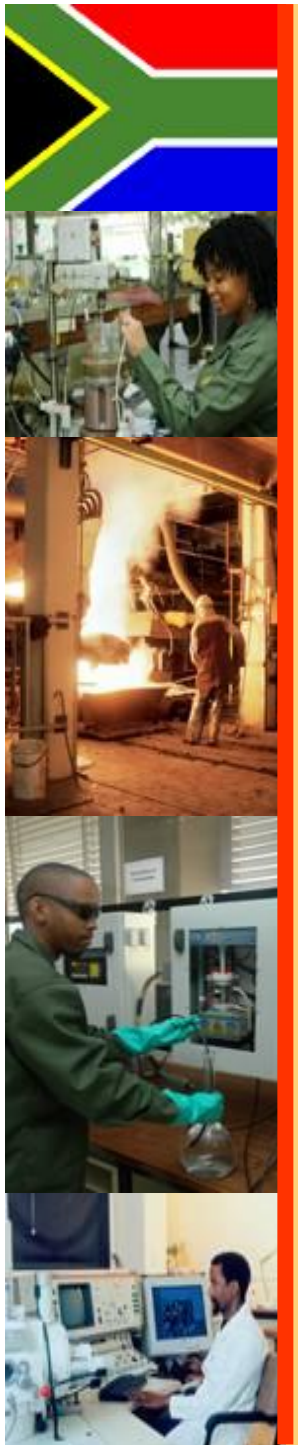

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An overview of HPGR testwork program at Mintek

5th June 2009

Johnny T. Kalala
Head of Comminution, Minerals Processing Division, Mintek

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

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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

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HPGR's on site at Mintek

1. Polysius HPGR

Studded rolls

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

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HPGR's on site at Mintek

2. Koppern HPGR

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

Hexadur Rolls

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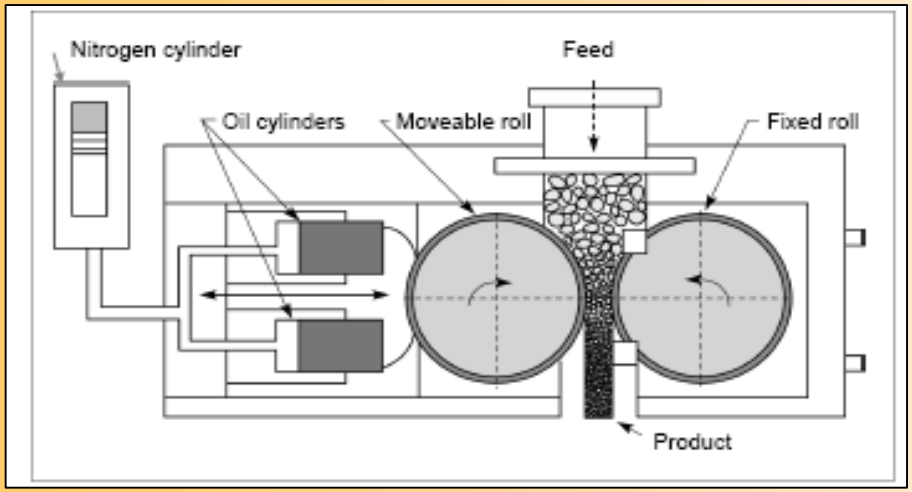
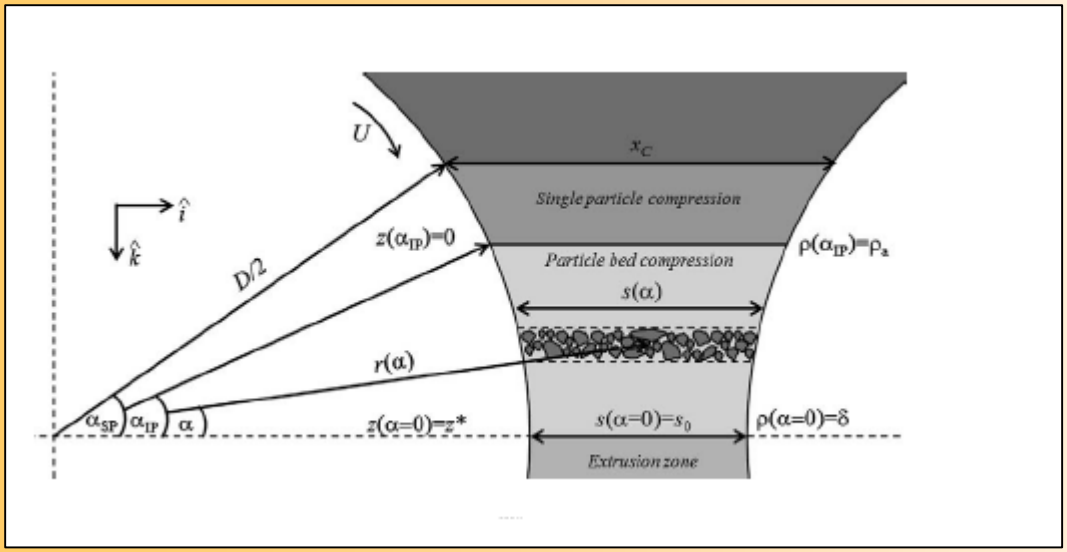
Crushing in a HPGR



Feed



Product

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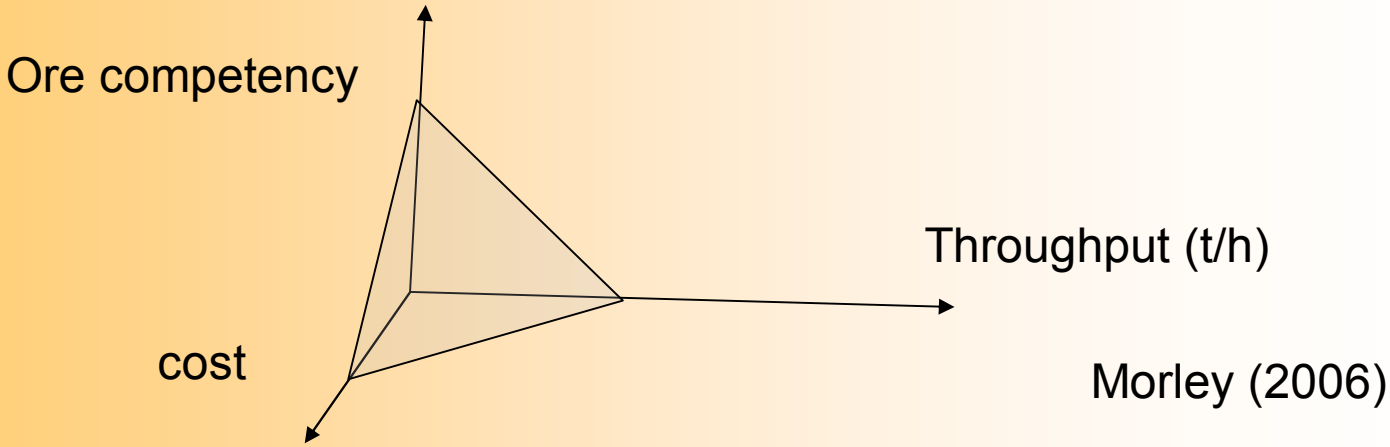
Key questions

- Amenability of different ore type to HPGR?



Morley (2006)

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

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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

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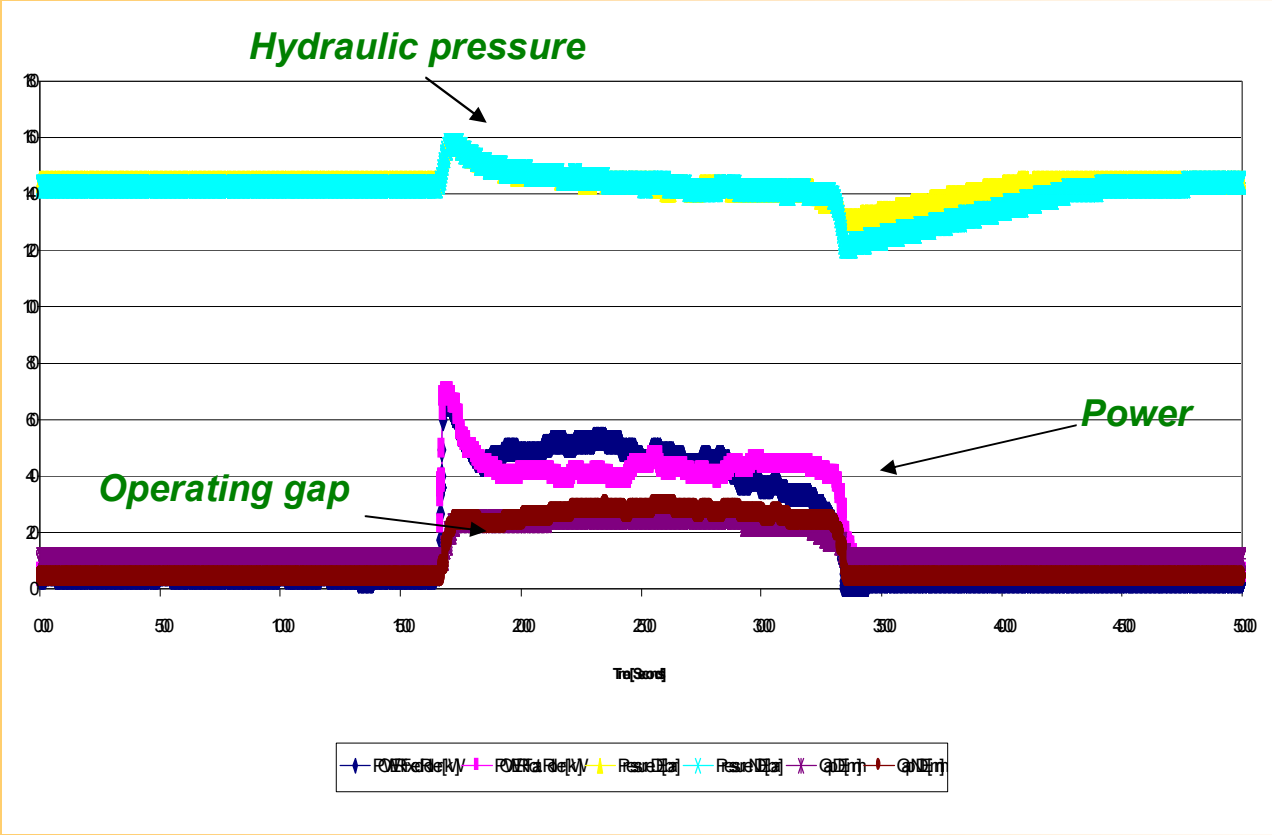
HPGR testwork program

I. Ore amenability

1. Influence of operating variables



Typical HPGR test output

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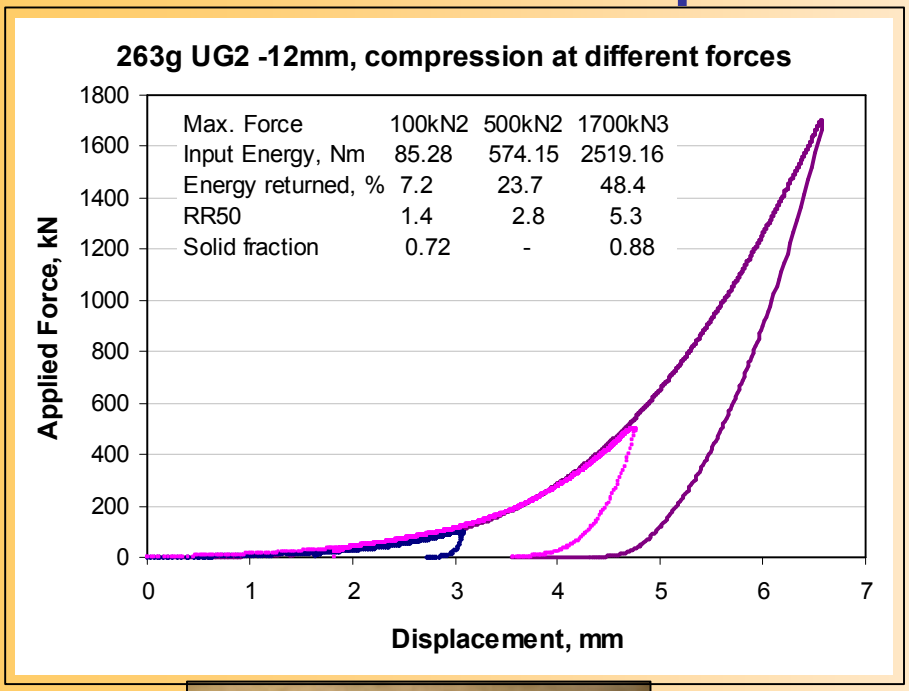
HPGR testwork program

I. Ore amenability

2. Piston die compression test



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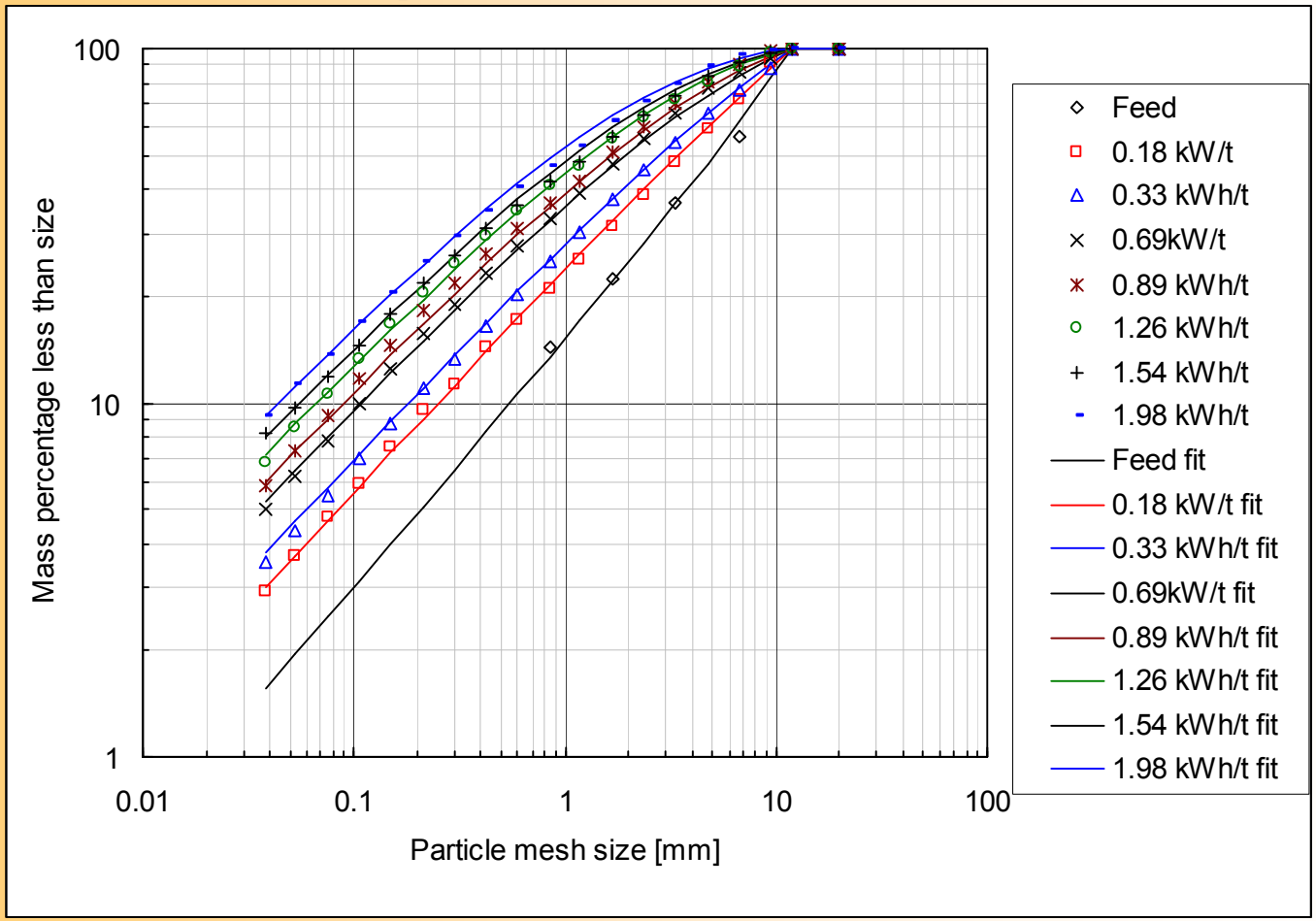
HPGR testwork program

I. Ore amenability

2. Piston die compression test



Merensky ore: top size 12 mm

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HPGR testwork program

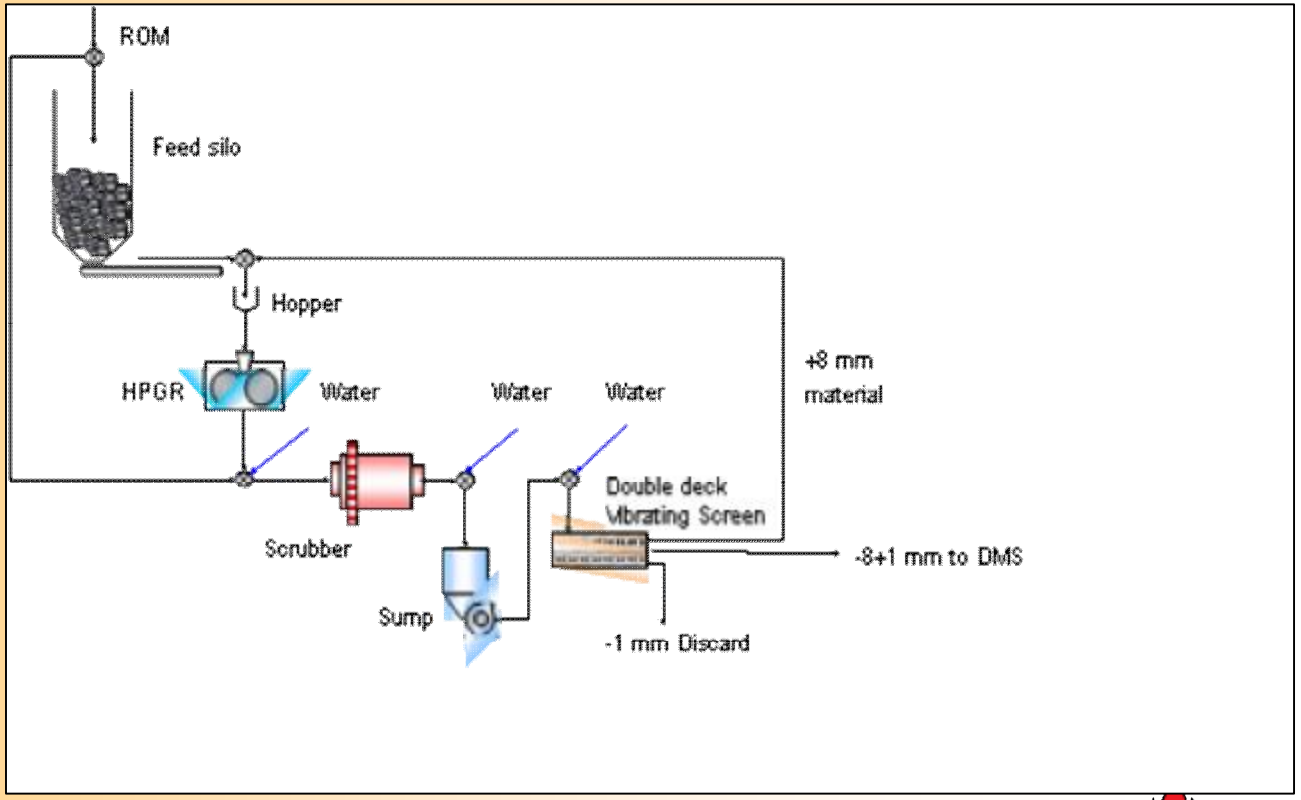
I. Ore amenability

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

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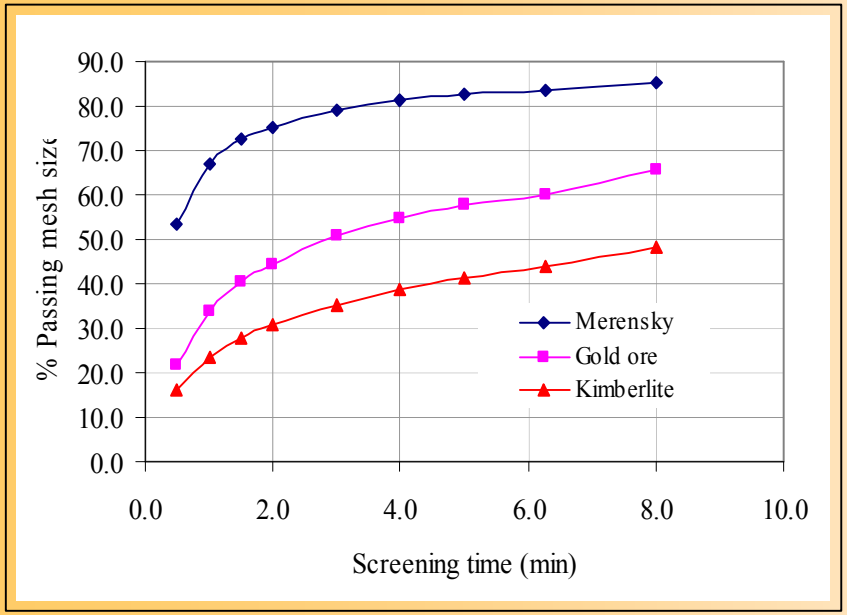
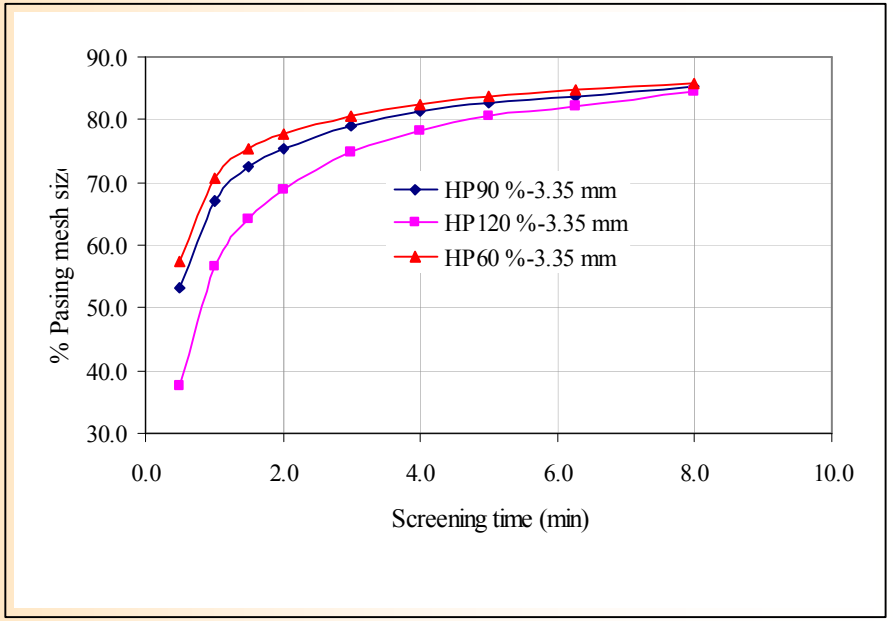
HPGR testwork program

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

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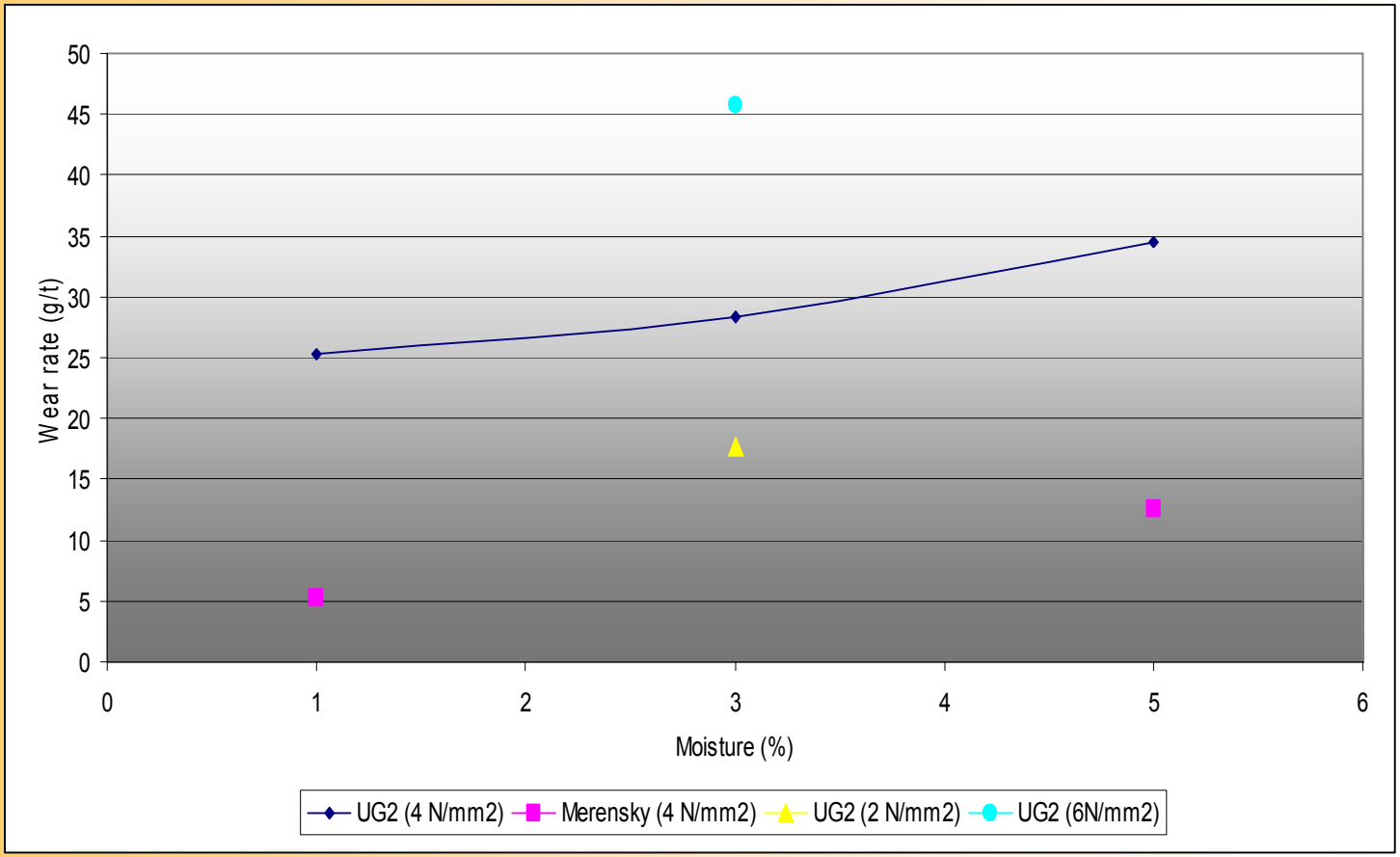
HPGR testwork program

I. Ore amenability

4. Wear test



UG2 and Merensky results on Polysius studded rolls

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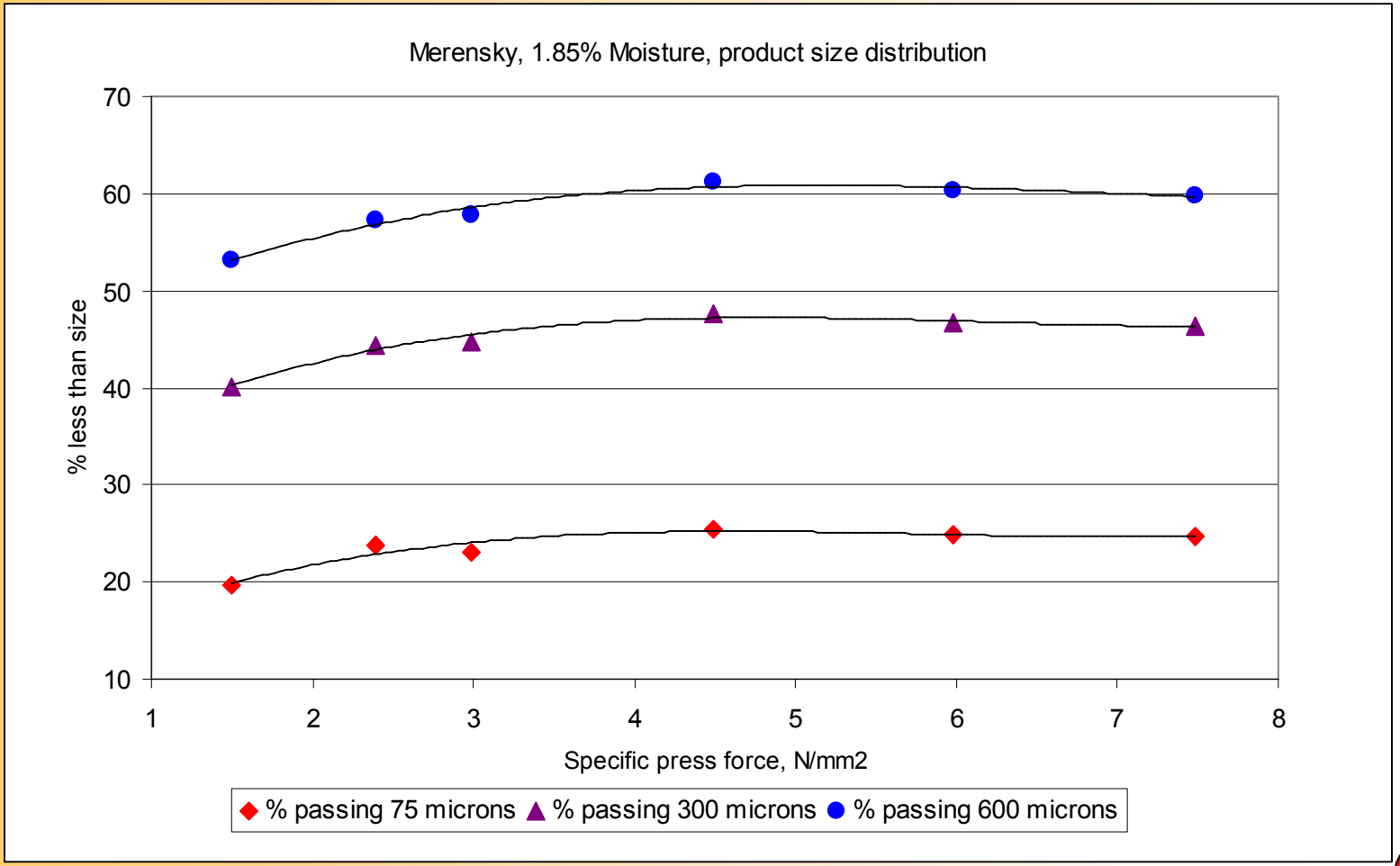
HPGR testwork program

II. Influence of operating conditions



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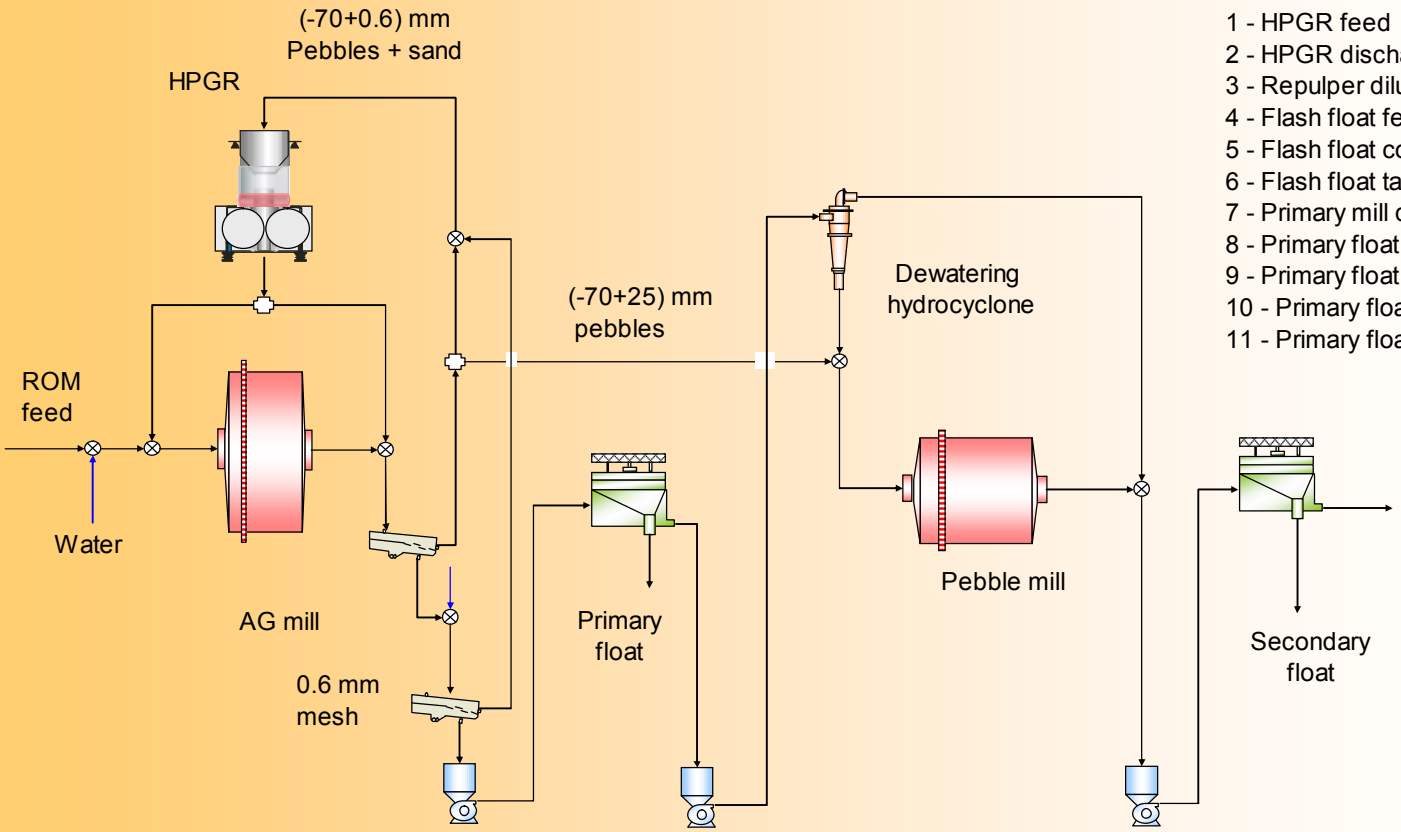
HPGR testwork program

III. Flowsheet development

Comminution circuit without using steel as grinding media



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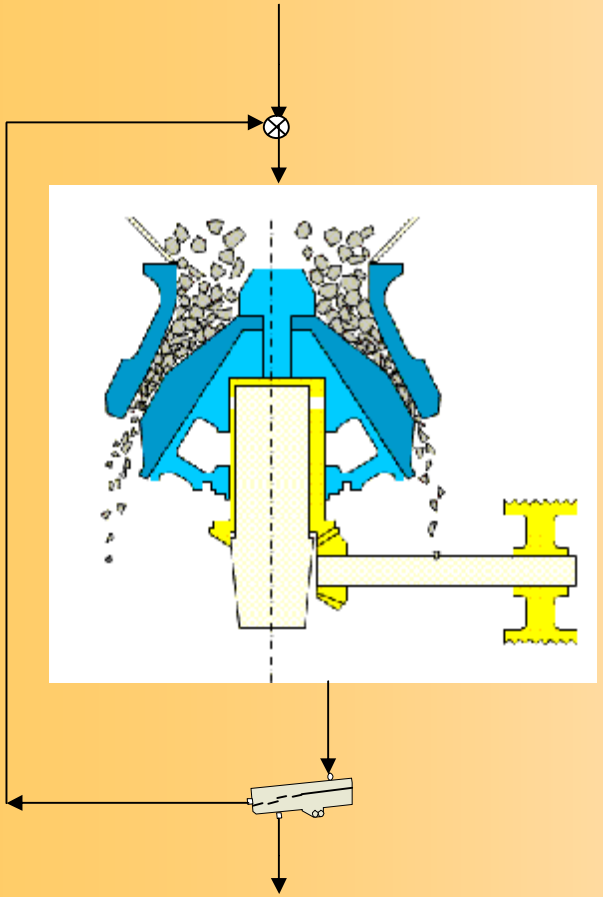
HPGR testwork program

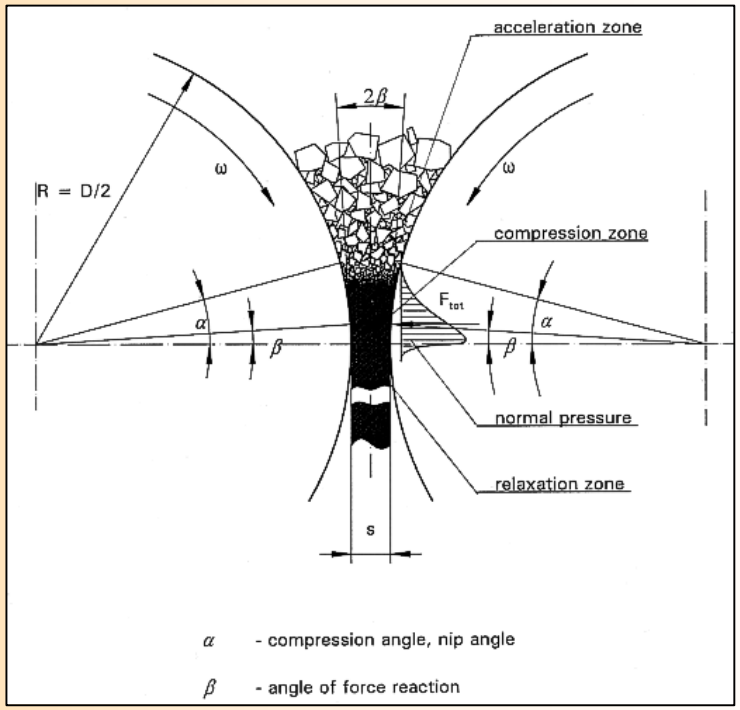
III. Flowsheet development

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

Action in a cone crusher



Action in a HPGR



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HPGR testwork program

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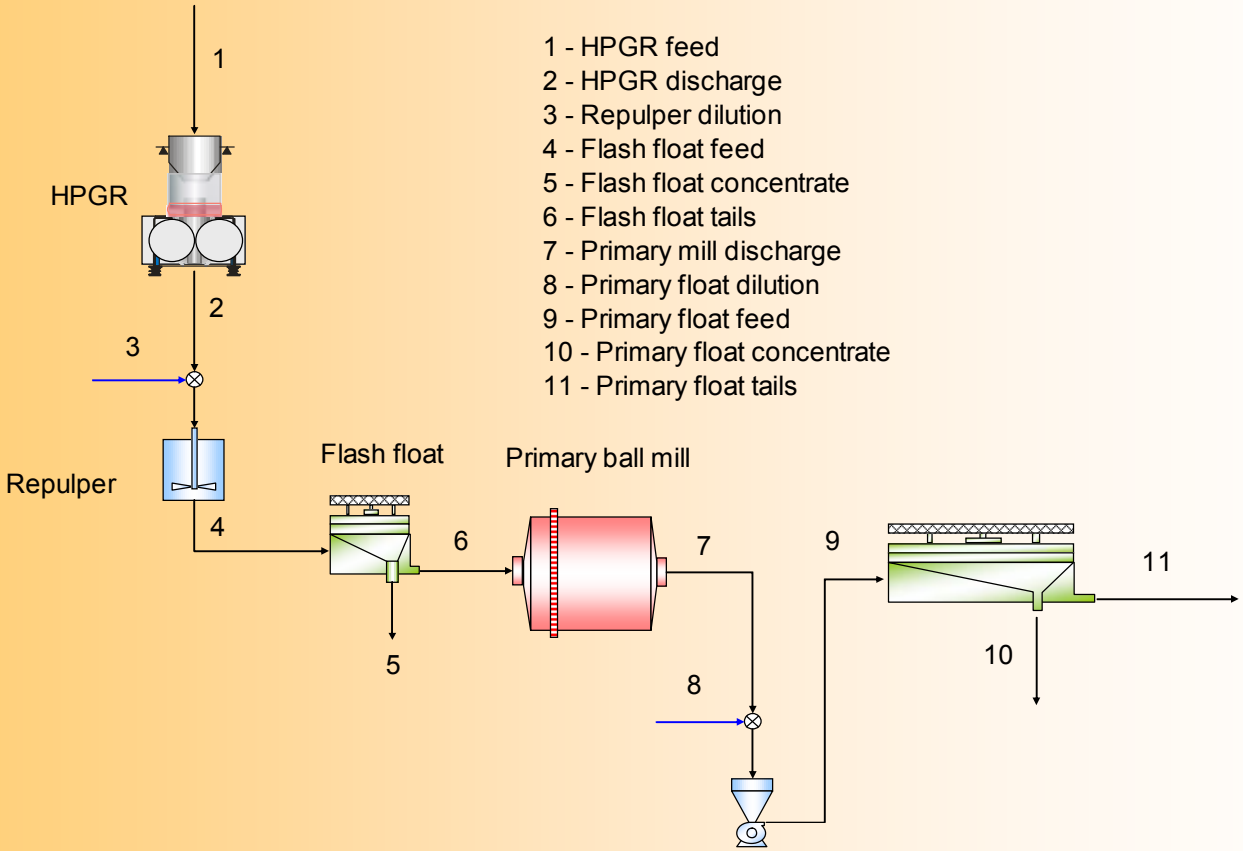

Basic Northam circuit

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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

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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

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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

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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.

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Acknowledgements

- Mintek
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Thank you

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