Comminution Handbook – Contents

Chap	oter 1
C	omminution – An Overview 1
	Introduction
	Context
	Background
	Fundamentals of comminution
	Breakage mechanisms
	Classification mechanisms
	Comminution machines
Chap	oter 2
М	ineral Liberation11
	Introduction
	Why is liberation necessary?
	How does liberation happen?
	Measuring liberation
	Modelling mineral liberation in comminution processes
	Mineral liberation in separation processes
Chap	oter 3
Pa	article Measurement Techniques25
	Introduction
	Sampling
	Wet/dry sieving
	Laser diffraction particle size analysis
	Sedimentation (sedigraph) and column settling
	Hydrocyclone methods
	Particle counting
	Surface charge techniques
	Photomicroscopy-optical
	Electron microscopy
	X-ray diffraction
	Surface area analysis
Chap	
O	re Comminution Measurement Techniques43
	Introduction
	Breakage definitions
	Bond grindability test
	Hardgrove grindability test
	Zeisel test
	Drop Weight Test
	SMC Test [®]

SPI° test SAGDesign™ test Compression test Bond Work Index values (Bond, 1953) Split Hopkinson pressure bar test	
Chapter 5	
Tumbling Mills	61
Introduction	
Ball mills for cement	
Ball/tube mills for coal	
Ball mills for ores	
Autogenous/semi-autogenous grinding mills	
Rod mills	
Rotary breakers for coal Scrubbers	
Grinding balls	
Building large tumbling mills	
Chapter 6	
Compression Machines	79
Introduction	
Primary crushers	
Conventional cone crushers	
High-capacity crushing circuits	
Bed breakage crushers	
Rolls crushers Mineral sizers	
Roller mills	
High-pressure grinding rolls	
Vertical roller mills	
Horomills	
Energy used in different circuits	
Chapter 7	
High-speed Impact Mills	99
Introduction	
Vertical shaft impact crushers	
Hammer mills	
Atrita mills (combined hammer and attrition mills) Beater wheel mills	
Chapter 8 Stirred Mills	107
Introduction	
Comminution in stirred mills	
Vertical stirred mills	
Horizontal stirred mills	
Hosokawa Alpine fine-grinding mills	

Chapter 9	
Mill Liners	125
The role of liners in tumbling mills	
Variations in liners for ore mills	
Materials of construction	
Potential issues with liners	
Types of liners	
Designing mill liners	
Liners for mill types Liners in cement mills	
Inspections, wear monitoring and ongoing optimisation Condition monitoring of liners	
Relining mills	
Chapter 10	1.45
Classifiers	145
Size separation in comminution processes Classification	
Trommels	
Rake and spiral classifiers	
Hydrocyclones	
Fine screens	
Air classifiers	
Chapter 11	
Comminution Circuits for Ores, Cement and Coal	167
Comminution circuits for ores	
Comminution circuits for cement clinker	
Comminution for coal preparation plants	
Control of coal mills in power stations	
Control of comminution circuits in coal preparation plants	
Control of comminution circuits in cement plants	
Chapter 12	
Milling Circuit Calculations	191
Introduction	
Classifier calculations – mass balancing and circulating load	
Power calculations using Bond grindabilities	
Chapter 13	
Modelling Comminution Circuits	215
Introduction	
Perfect mixing ball mill model	
Efficiency curve model for classifiers	
Fitting example for ball mill – hydrocyclone circuit	
Conclusions	

Chapter 14
Process Control
Introduction
Process measurement
Control elements
Transmission
Process control systems and devices
Measurement and control costs – 'rule of thumb'
Grinding circuit control
Response of the semi-autogenous grinding mill to change in feed rate
Control of a crusher
Role of the metallurgist
Process control techniques and skills
Advanced process control systems
Chapter 15
Case Studies of Control Systems
Introduction
Grinding circuit control at the Phu Kham mine in Laos
Grinding circuit control at Newmont's Ahafo gold mine in Ghana
Chapter 16
Circuit Design
Project definition
Process development and circuit design
Sample selection and test work
Design criteria
Flow sheet options
Comminution energy calculations
Equipment sizing and selection
Plant layout