6

Contents

Section A – Process summaries

1. Introduction

1. The basics of cement manufacture – 2. History of cement manufacture – 3. Portland cement in today's world

2. Raw materials

1. Raw materials – 2. Raw mix – 3. Reserves – 4. Crushing – 5. Drying – 6. Pre-blending – 7. Storage and handling

3. Raw milling and blending

1. Raw milling – 2. Blending – 3. Kiln feed

4. Flames and fuels

1. Chemistry of combustion – 2. Fuels – 3. Physics of combustion – 4. Burner design – 5. Cement kiln burners – 6. Heat transfer – 7. Pollutant formation – 8. Modelling – 9. Fuel storage and firing systems in practice – 10. Insufflation – 11. Alternative and waste fuels

5. Burning and cooling

1. Chemical reactions – 2. Process variants – 3. Kiln burning - 4. Kiln control – 5. Volatiles in the kiln – 6. Kiln bypass – 7. Kiln start-up and shutdown – 8. Kiln refractories – 9. Clinker cooling – 10. Kiln mechanical – 11. Emergency power – 12. Plant control systems

6. Cement milling

1. Storage of clinker and other components – 2. Cement milling – 3. Separators (classifiers) – 4. Ball mill circuit control – 5. Cement storage – 6. Cement dispatch – 7. Distribution – 8. Quality assurance and customer service

7. Quality control

1. Sampling – 2. Chemical analysis – 3. Particle size analysis – 4. Thermal analysis – 5. Microscopy – 6. Virtual Cement and Concrete Testing Laboratory (VCCTL) - 7. Calorimetry – 8. Burnability – 9. Grindability – 10. Physical testing – 11. Process control analysis – 12. Chromate passivation – 13. Cement quality – 14. Setting time – 15. ASTM cement types and specifications – 16. European EN 197 cement specification – 17. Composite cements (intergrinds and blends) – 18. Supersulphated cement – 19. Calcium aluminate cement (CAC) – 20. Shrinkage-compensating cements (SCC) – 21. ISO 9001:2000 Quality management system – 22. Concrete problems

8. Maintenance

1. Maintenance benefits and costs – 2. Failure modes – 3. Computerised Maintenance Management Systems (CMMS) – 4. Reliability-Centred Maintenance (RCM) – 5. Maintenance cost management – 6. Maintenance organisation – 7. Role, planning and control – 8. Mobile equipment maintenance – 9. People and indicators

<u>76</u>

10

16

30

38

110

134

168

9. Environment and pollution control

1. Dust collection – 2. Pollution control – 3. ISO 14000 – 4. Sustainable development and climate change

10. Hydration of Portland cement

1. Initial stage – 2. Induction or dormant stage – 3. Acceleration stage – 4. Deceleration stage

11. Plant reporting

1. Definitions – 2. List of reports – 3. Inventories and feeders – 4. Downtime reporting – 5. Miscellaneous reporting – 6. Typical daily production report – 7. Typical process summary data – 8. Typical equipment downtime report – 9. Plant manning

12. Accounting

1. Cost or management accounting – 2. Investment justification – 3. Capacity increase by process change – 4. Project cost estimation – 5. Financial statements

13. Technical and process audits

1. Historical performance – 2. Kiln specific fuel consumption – 3. Cement mill specific power consumption – 4. Other systems – 5. De-bottlenecking – 6. Project audit – 7. Risk assessment

14. Plant assessment list

1. General – 2. Administration and commercial – 3. Communication with stakeholders – 4. Quarry – 5. Drying – 6. Raw milling – 7. Blending – 8. Kiln – 9. Fuel – 10. Clinker – 11. Finish mill – 12. Cement – 13. Quality control – 14. Packing and distribution – 15. Emission abatement (dust, NO_x , SO_2 , etc) – 16. Maintenance – 17. Process – 18. Materials analysis –19. Plant capacity summary – 20. Storage capacity

15. Cement plant construction and valuation

1. New plant construction – 2. Project management – 3. Cement plant investment costs – 4. Project phases – 5. Plant valuation

Section B – Process calculations and miscellaneous data

B1. Power

1. Specific power consumption - 2. Power conservation – 3. Three-phase power – 4. Motor power output – 5. Peak power tariffs – 6. Power generation – 7. Cogeneration

B2. Fans and air handling

1. Fan laws – 2. Fan mechanical – 3. Impeller build-up – 4. Gas properties – 5. Plant air distribution – 6. Pitots, orifices and venturis – 7. False air – 8. Dust loading – 9. Stack draught – 10. Dewpoint of moist air at atmospheric pressure – 11. Spray cooling of gas – 12. Abrasion resistance

B3. Conveying

1. Comparative power consumption for lift – 2. Pneumatic conveying – 3. Bucket elevator power – 4. Belt conveyor power – 5. Screw conveyor power – 6. Airslide – 7. Drag chain power – 8. Tube belt conveyor – 9. Air-supported belt conveyor – 10. Sandwich conveyor – 11. Modified belt conveyor – 12. Capsule conveyor – 13. Water pump power

272

234

262

265

<u>198</u>

202

177

224

212

237

244

B4. Milling

1. Sieve sizes – 2. Circulating load – 3. Classifier recovery – 4. Tromp curve – 5. Mill critical speed - 6. Charge volume loading – 7. Grace factor and other ball mill parameters – 8. Mill power – 9. Ball weight and surface area – 10. Maximum ball size required –11. Measurement of wear – 12. Effects of gypsum upon setting time

B5. Kilns and burning

1. Cement compounds and ratios – 2. Coating tendency – 3. Burnability factor – 4. Required burning temperature – 5. Theoretical heat of formation of clinker – 6. Kiln gas velocities – 7. Kiln heat balance – 8. Kiln specific heat loading (SHL) – 9. Kiln retention time – 10. Kiln volume loading – 11. Kiln capacity vs diameter – 12. Kiln drive power – 13. Cooler efficiency – 14. Kiln exhaust gas (coal) – 15. Circulation of volatile components –16. Estimation of kiln bypass –17. Other kiln types

B6. Fuels

1. Typical data for solid fuels – 2. Typical data for liquid fuels – 3. Typical data for gaseous fuels

B7. Materials

1. Bulk densities of materials for silo storage – 2. Specific gravities and grindabilities – 3. Solubilities of sulphates – 4. Rates of dissolution of different forms of calcium sulphate at 20° C – 5. Influence of temperature on the solubilities of various sulphate forms – 6. Chemical formula weights – 7. Coefficients of linear expansion

B8. Statistics

B9. Miscellaneous data

1. Atmospheric pressure and density vs altitude (0°C) – 2. pH and normality – 3. Laboratory reagents (aqueous solutions) – 4. Seawater composition – 5. Abundance of elements in earth's crust – 6. Hardness of materials – 7. Earthquake scales – 8. Beaufort wind scale – 9. World cement production –10. Regional cement consumption data –11. EU Environmental legislation –12. Ship and truck capacities –13. Patents

B10. Conversion tables3171. Length - 2. Volume - 3. Pressure - 4. Weight - 5. Area - 6. Density - 7. Energy - 8. Force - 9. Miscellaneous

References	318
Index	335
Advertisers' index	338

276

284

299

302

305

310