

*Woodhead Publishing Series in Textiles***Part I Introduction to yarn spinning and structure**

| | | |
|-----|---|----|
| 1 | Overview of developments in yarn spinning technology C. A. LAWRENCE, University of Leeds, UK | 3 |
| 1.1 | Introduction | 3 |
| 1.2 | Early history | 4 |
| 1.3 | Early developments | 9 |
| 1.4 | Ring spinning | 22 |
| 1.5 | Modern spinning methods and developments: an overview | 25 |
| 1.6 | Twist spinning methods | 26 |
| 1.7 | Wrap spinning methods | 34 |
| 1.8 | Conclusions | 39 |
| 1.9 | References | 40 |
| 2 | Fundamental principles of ring spinning of yarns R. S. RENGASAMY, IIT Delhi, India | 42 |
| 2.1 | Introduction | 42 |
| 2.2 | Basic principles of spinning | 43 |
| 2.3 | Ring spinning | 44 |
| 2.4 | Ring spinning systems | 49 |
| 2.5 | Description of the ring spinning process | 49 |
| 2.6 | Post-spinning | 72 |
| 2.7 | Applications of ring spinning | 74 |
| 2.8 | Future trends | 76 |
| 2.9 | References and bibliography | 77 |

| | | |
|------|---|-----|
| 3 | Fundamental principles of open end yarn spinning A. DAS and R. ALAGIRUSAMY, IIT Delhi, India | 79 |
| 3.1 | Introduction | 79 |
| 3.2 | Commercial open end spinning systems: rotor spinning | 81 |
| 3.3 | Friction spinning | 84 |
| 3.4 | Vortex spinning | 93 |
| 3.5 | Conclusions | 98 |
| 3.6 | References | 98 |
| 4 | Blending and composite yarn spinning M. R. MAHMOUDI, University of Leeds, UK | 102 |
| 4.1 | Introduction: the purpose of blending | 102 |
| 4.2 | Blending and yarn properties | 105 |
| 4.3 | Blending methods | 108 |
| 4.4 | Carding | 112 |
| 4.5 | Measuring the effectiveness of blending | 115 |
| 4.6 | References and sources of further information | 118 |
| 5 | Yarn structure and properties from different spinning techniques G. K. TYAGI, The Technological Institute of Textile and Sciences, India | 119 |
| 5.1 | Introduction | 119 |
| 5.2 | Ring spun yarns | 120 |
| 5.3 | Rotor spun yarns | 126 |
| 5.4 | Air-jet spun yarns | 134 |
| 5.5 | Friction spun yarns | 141 |
| 5.6 | Wrap spun yarns | 146 |
| 5.7 | Structure–property relationships of staple spun yarns | 147 |
| 5.8 | The plying of staple fibre yarns | 149 |
| 5.9 | Future trends | 150 |
| 5.10 | Acknowledgements | 151 |
| 5.11 | References | 151 |
| 6 | Yarn structural requirements for knitted and woven fabrics H. M. BEHERY, Clemson University, USA | 155 |
| 6.1 | Introduction | 155 |
| 6.2 | Fiber types and their classification | 156 |
| 6.3 | Principal requirements for knitted fabric end uses | 156 |
| 6.4 | Principal requirements for woven fabric end uses | 161 |
| 6.5 | Yarn types and their classification | 167 |

| | | |
|--|--|-----|
| 6.6 | Fiber/yarn/manufacturing process interactions and their effect on yarn structure | 176 |
| 6.7 | Survey of yarn properties | 177 |
| 6.8 | Criteria for choice of fibers and yarns to suit fabric end use and performance | 179 |
| 6.9 | Conclusions | 180 |
| 6.10 | Sources of further information and advice | 181 |
| 6.11 | References and bibliography | 181 |
| 6.12 | Appendix: Glossary and definitions of physical and mechanical properties of fibers, yarns and fabrics | 182 |
| Part II Advances in particular yarn spinning technologies | | |
| 7 | Developments in ring spinning R. S. RENGASAMY, IIT Delhi, India | 193 |
| 7.1 | Introduction | 193 |
| 7.2 | Main technologies of spinning | 194 |
| 7.3 | Advantages and limitations of ring spinning | 194 |
| 7.4 | Developments in ring spinning | 195 |
| 7.5 | Future trends | 216 |
| 7.6 | References and bibliography | 216 |
| 8 | Siro and Solo spinning P. R. LAMB and X. WANG, Deakin University, Australia | 217 |
| 8.1 | Introduction | 217 |
| 8.2 | Background | 217 |
| 8.3 | Sirospun | 219 |
| 8.4 | Solospun | 225 |
| 8.5 | Types of fibres used | 227 |
| 8.6 | Yarn quality and properties achieved | 228 |
| 8.7 | Advantages and limitations | 229 |
| 8.8 | Applications | 231 |
| 8.9 | The development of ancillary processes | 232 |
| 8.10 | Future trends | 233 |
| 8.11 | Sources of further information and advice | 234 |
| 8.12 | References | 234 |
| 9 | Compact spinning technology M. A. M. EL-SAYED and S. H. SANAD, Agricultural Research Centre, Cotton Research Institute, Egypt | 237 |
| 9.1 | Introduction | 237 |
| 9.2 | Types of fibre used | 247 |

| | | |
|------|---|-----|
| 9.3 | Yarn quality and properties | 249 |
| 9.4 | Advantages and limitations of compact spinning | 251 |
| 9.5 | Applications of compact yarn on downstream processing | 253 |
| 9.6 | Future trends | 254 |
| 9.7 | Sources of further information and advice | 258 |
| 9.8 | References | 259 |
| 10 | Rotor spinning A. DAS and R. ALAGIRUSAMY, IIT Delhi, India | 261 |
| 10.1 | Introduction | 261 |
| 10.2 | Key features and operating principles of rotor spinning systems | 262 |
| 10.3 | Fibre transfer | 265 |
| 10.4 | Modern rotor spinning machines | 269 |
| 10.5 | Rotor spinning performance: yarn breakage | 270 |
| 10.6 | Structure and properties of rotor spun yarns | 271 |
| 10.7 | Conclusions | 272 |
| 10.8 | References | 273 |
| 11 | Friction spinning A. A. MERATI, Amirkabir University of Technology, Iran | 274 |
| 11.1 | Introduction | 274 |
| 11.2 | Yarn formation on friction-spinning machines | 277 |
| 11.3 | Composite yarn spinning on friction spinning | 286 |
| 11.4 | Types of fibres used | 289 |
| 11.5 | Friction-spun yarn structure and properties | 291 |
| 11.6 | Advantages and limitations of friction spinning | 306 |
| 11.7 | Application of friction-spun yarns | 308 |
| 11.8 | Future trends | 309 |
| 11.9 | References and bibliography | 310 |
| 12 | Air-jet spinning R. A. ANGELOVA, Technical University of Sofia, Bulgaria | 315 |
| 12.1 | Introduction | 315 |
| 12.2 | Basic air-jet spinning methods | 318 |
| 12.3 | Types of fibres used | 324 |
| 12.4 | Fasciated structure of air-jet spun yarns | 326 |
| 12.5 | The basic principles of the twisting mechanism by swirl flow | 331 |
| 12.6 | Simulation of the flow–yarn interaction | 337 |
| 12.7 | Properties of air-jet spun yarns | 339 |
| 12.8 | Advantages and limitations of air-jet spinning | 340 |

| | | |
|-------|---|-----|
| 12.9 | Applications of air-jet spun yarns | 341 |
| 12.10 | Future trends | 342 |
| 12.11 | References | 342 |
| 13 | Hollow spindle spinning | 345 |
| | R. A. ANGELOVA, Technical University of Sofia, Bulgaria | |
| 13.1 | Introduction | 345 |
| 13.2 | Basic principle of hollow spindle spinning | 346 |
| 13.3 | Structure of yarns made by hollow spindle machines | 352 |
| 13.4 | Assessment of the quality of wrap yarns | 355 |
| 13.5 | Application of hollow spindle spun yarns | 358 |
| 13.6 | Advantages and limitations of hollow spindle spinning | 359 |
| 13.7 | Future trends | 361 |
| 13.8 | References | 362 |
| 14 | Self-twist spinning | 365 |
| | M. R. MAHMOUDI, University of Leeds, UK | |
| 14.1 | Introduction | 365 |
| 14.2 | Self-twist spinning: principles | 368 |
| 14.3 | Self-twist spinning technology | 369 |
| 14.4 | Factors affecting strand twist | 376 |
| 14.5 | Self-twist yarn strength and stability | 381 |
| 14.6 | References and sources of further information | 387 |
| 15 | Minimizing fiber damage caused by spinning | 390 |
| | Y. ELMOGAHZY and R. FARAG, Auburn University, USA | |
| 15.1 | Introduction | 390 |
| 15.2 | Textile fiber characteristics and processing | 391 |
| 15.3 | Fiber breakage | 393 |
| 15.4 | Fiber damage in the yarn-forming process | 402 |
| 15.5 | Fiber damage in ring and compact spinning | 402 |
| 15.6 | Fiber damage in rotor spinning | 408 |
| 15.7 | Fiber damage in friction spinning | 409 |
| 15.8 | Conclusion | 412 |
| 15.9 | References | 414 |
| 16 | Spin finishes for textiles | 416 |
| | I. A. ELHAWARY, Alexandria University, Egypt | |
| 16.1 | Introduction | 416 |
| 16.2 | Components of spin finishes | 417 |
| 16.3 | Types and application of spin finishes | 418 |
| 16.4 | Key requirements for spin finishes | 420 |

| | | |
|-------|---|-----|
| 16.5 | Quality issues in the use of spin finishes | 422 |
| 16.6 | Use of spin finishes on particular types of fibre | 423 |
| 16.7 | Use of spin finishes with particular spinning systems | 425 |
| 16.8 | Testing spin finishes | 427 |
| 16.9 | Sources of further information and advice | 429 |
| 16.10 | Acknowledgement | 429 |
| 16.11 | References | 429 |
| | <i>Index</i> | 431 |