
The Chemistry of Textile Fibres

3rd Edition

By

Robert R. Mather

Power Textiles Limited, UK

Email: mather44robert@gmail.com

Roger H. Wardman

Formerly, Heriot-Watt University, UK

Email: Rhwardman@aol.com

and

Sohel Rana

Indian Institute of Technology, Delhi, India

Email: sohelrana@textile.iitd.ac.in



**ROYAL SOCIETY
OF CHEMISTRY**

Contents

1	The Scope of Textile Fibres	1
1.1	Introduction	1
1.2	Classification of Textile Fibres	2
1.3	Fibre Production Statistics	5
1.4	Characteristics of Textile Fibres	7
1.5	Requirements of Fibre-forming Polymers	9
1.6	Properties of Textile Fibres	12
	Suggested Further Reading	23

2	Cellulosic Fibres	26
2.1	Introduction	26
2.2	Seed Fibres	26
2.3	Bast Fibres	50
2.4	Leaf Fibres	64
2.5	Other Polysaccharide Fibres	64
2.6	Cellulose Micro- and Nanostructures	67
	Suggested Further Reading	76

3	Protein Fibres	77
3.1	Introduction	77
3.2	Wool	77

The Chemistry of Textile Fibres: 3rd Edition

By Robert R. Mather, Roger H. Wardman and Soheli Rana

© Robert R. Mather, Roger H. Wardman and Soheli Rana 2024

Published by the Royal Society of Chemistry, www.rsc.org

3.3	Speciality Mammalian Fibres	110
3.4	Silk	112
3.5	Spider Silk	119
3.6	Alternative Proteins	122
	Suggested Further Reading	122
4	Regenerated Fibres	123
4.1	Regenerated Cellulosic Fibres	123
4.2	Regenerated Protein Fibres	157
	Suggested Further Reading	163
5	Synthetic Fibres	165
5.1	General Introduction	165
5.2	Processing of Synthetic Fibres	167
5.3	Polyamide Fibres	175
5.4	Polyester Fibres	193
5.5	Acrylic and Modacrylic Fibres	211
5.6	Polyolefin Fibres	224
5.7	Elastomeric Fibres	237
5.8	Polyvinyl Alcohol Fibres	249
5.9	Microfibres	249
5.10	Bicomponent Fibres and Polymer Blends	251
	Suggested Further Reading	255
6	High-performance Fibres	256
6.1	Introduction	256
6.2	Aramid Fibres	258
6.3	Aromatic Polyester Fibres	266
6.4	Polybenzimidazole Fibres	270
6.5	Polyimide Fibres	274
6.6	Poly(<i>p</i> -Phenylene Benzobisoxazole) Fibres	278
6.7	Fluoropolymer Fibres	280
6.8	Carbon Fibres	282

6.9	Thermoset Polymer Fibres	289
6.10	Ceramic Fibres	292
	Suggested Further Reading	294

7 Other Speciality Fibres 295

7.1	Nanofibres	295
7.2	Electrically Conducting Fibres	308
7.3	Optical Fibres	327
7.4	Luminescent Fibres	342
7.5	Biodegradable Fibres	345
	Suggested Further Reading	356

8 Enhancement of Fibre Performance by Surface Modification 358

8.1	Introduction	358
8.2	Wetting and Wicking Properties of Textiles	359
8.3	Surface Treatments	368
8.4	Sol-Gel Finishing	406
8.5	Functionalisation Using Carbon Nanotubes	416
	Suggested Further Reading	418

9 The Chemistry of Functional Fibres and Fabrics 420

9.1	Introduction	420
9.2	Responsive Surface Treatments	420
9.3	Waterproof Breathable Fabrics	429
9.4	Thermoregulating Fabrics	437
9.5	Controlled-release Coatings	442
9.6	Self-cleaning Fabrics	450
9.7	Shape Memory Materials	454
9.8	Energy Harvesting Fabrics	459
	Suggested Further Reading	462

Appendices	465
A.1 Appendix I: Units of Measurement Used to Characterise Textile Fibres	465
A.2 Appendix II: Some Terms and Definitions Used in Textile Manufacture	468

Subject Index	475
----------------------	------------