Contents

Preface for Volume 2 ---- V

Chapter	5
Sonoche	mical synthesis —— 1
5.1	Historical introduction —— 1
5.1.1	Mechanistic aspects —— 2
5.1.2	Synthetic aspects — 5
5.2	Sonochemical synthesis in Coventry —— 13
5.2.1	The Ullmann reaction —— 13
5.2.2	Halogenation of aromatics using CuBr ₂ supported on alumina —— 14
5.2.3	O-Alkylation of hindered phenols — 15
5.2.4	O-Alkylation of 5-hydroxychromones —— 18
5.2.5	Ultrasonic effects on metal powders and sonochemical catalysis —— 22
5.3	Sonochemical synthesis in Romania —— 35
5.3.1	Charge transfer complexes —— 35
5.3.2	Self-assembly membranes —— 49
5.3.3	Attempts to cause automerization of C ¹³ -labelled
	naphthalene —— 51
5.3.4	Ultrasound-assisted esterification using enzymes —— 51
5.3.5	Sonochemical preparation of catalysts — 54
5.4	Concluding remarks —— 56
	References —— 56
Chapter	
	coating, metallurgy and materials technology —— 63
6.1	Introduction —— 63
6.2	Electroplating with ultrasound — 63
6.2.1	Introduction —— 63
6.2.2	Electroplating in Coventry —— 67
6.3	Electroless plating with ultrasound —— 73
6.3.1	Electroless nickel —— 74
6.3.2	Electroless copper —— 75
6.4	Printed circuit board technology — 77
6.4.1	Surface preparation —— 78
6.4.2	Electroless plating on PCBs —— 82
6.4.3	Improved solder joints in PCBs —— 84
6.5	Production of nanoparticles using pulsed

sonoelectrochemistry —— 86



	-
6.5.1	Introduction —— 86
6.5.2	Metal nanoparticle synthesis in Coventry – the SELECTNANO
	project — 88
6.6	Metallurgy —— 90
6.6.1	Introduction to light metal casting —— 92
6.6.2	Preliminary work at Coventry —— 93
6.6.3	1996 Coventry group visit Moscow —— 96
6.7	The joint venture company Industrial Applications for Ultrasonics
	(IUS) —— 97
6.7.1	Ultrasonic treatment of molten and solidifying aluminium —— 98
6.7.2	Ultrasonic impact treatment of metal surfaces —— 100
6.7.3	Electric arc welding with ultrasonics —— 100
6.7.4	Ultrasonically assisted metal on metal coating — 101
6.7.5	Ultrasonics for Al-Pb antifriction composites — 101
6.8	Polymer science —— 102
6.8.1	Polymer degradation —— 102
6.8.2	Radical polymerization —— 104
6.8.3	Emulsion polymerization —— 105
6.8.4	Electroinitiated polymerization —— 106
6.9	Small projects with industry —— 107
6.9.1	Ultrasonically assisted spray coating —— 107
6.9.2	Encapsulation —— 109
6.9.3	Crystallization – the synthesis of zeolites —— 110
6.10	Concluding remarks —— 111
	References —— 112
Chapter 7	
Therapeutic	: ultrasound 117
7.1	General introduction — 117
7.2	Low-frequency ultrasound 20–100 kHz —— 118
7.2.1	Cutting and drilling in dentistry and surgery —— 118
7.2.2	Emulsification for removal of tissue —— 119
7.2.3	Ultrasonic thrombolysis for the removal of blood clots —— 119
7.2.4	Synthesis of microcapsules for drug delivery — 120
7.3	High-frequency ultrasound 1–5 MHz —— 121
7.3.1	Non-therapeutic applications of high-frequency ultrasound —— 121
7.3.2	Therapeutic applications of high-frequency ultrasound —— 123
7.4	The Sonochemistry Centre and therapeutic ultrasound —— 127
7.4.1	Conferences involving sonochemistry and therapeutic
	medicine —— 128
7.4.2	Dentistry —— 132
7.4.3	Transdermal drug delivery and enhanced cell permeability — 134

7.4.4	The links between HIFU in Chongqing and the Sonochemistry Centre in Coventry —— 138
7.4.5	Microcapsules for targeted drug delivery —— 146
7.4.6	Research collaboration with Wu Wei —— 153
7.5	Concluding remarks —— 155
	References —— 155
Chapter 8	
Power ultra	sound in food technology —— 161
8.1	Historical introduction —— 161
8.1.1	Mechanical effects of ultrasound —— 161
8.1.2	Chemical and biological effects of ultrasound —— 173
8.2	Food technology at Coventry: links with industry —— 178
8.2.1	Leatherhead Food Research Association (LFRA) —— 179
8.2.2	Campden and Chorleywood Food Research Association
	(CCFRA) —— 182
8.2.3	Mars Foods —— 186
8.2.4	Unilever —— 189
8.2.5	Kraft Foods —— 190
8.3	Ultrasound and food technology at Coventry: academic links — 193
8.3.1	1996 food conference and the book Ultrasound in food
	processing —— 193
8.3.2	Review articles from the Coventry group —— 194
8.3.3	International collaboration via research exchanges with other
	university groups —— 198
8.4	Food research in Romania —— 202
8.4.1	Sonicated champagne research project —— 202
8.4.2	Extraction of natural sweeteners from Stevia —— 203
8.5	Concluding remarks —— 204
	References —— 205
Chapter 9	
Textile and	leather processing —— 213
9.1	Introduction —— 213
9.2	Production processes in the textile industry —— 213
9.2.1	Fibre production —— 213
9.2.2	Yarn production —— 216
9.2.3	Fabric production —— 219
9.3	Fabric treatment —— 221
9.3.1	Washing —— 223
9.3.2	Scouring —— 226
9.3.3	Carbonizing —— 227

9.3.4	Sizing —— 227
9.3.5	Desizing —— 228
9.3.6	Mercerization —— 228
9.3.7	Bleaching — 229
9.3.8	The use of enzymes —— 229
9.4	Final treatment of fabrics — 230
9.4.1	Dyeing —— 230
9.4.2	Biocidal treatment — 232
9.5	Sonochemical production of antimicrobial fabrics —— 233
9.5.1	The SONO project for antimicrobial fabrics —— 234
9.5.2	Mechanism for the production of metal oxide nanoparticles in the SONO process —— 235
9.5.3	Impregnation of metal oxide nanoparticles into the fabric in the SONO process —— 236
9.5.4	The pilot plant installations —— 237
9.5.5	Biocidal efficiency of the treated fabrics — 238
9.6	Developments in the impregnation of fabrics with biocidal
	nanoparticles after the SONO project —— 239
9.6.1	Modification of the Viatech system —— 239
9.6.2	Developments in Coventry —— 240
9.6.3	Developments in Bucharest —— 241
9.7	Production processes in the leather industry —— 242
9.7.1	Historical —— 243
9.7.2	Production processes in the leather industry —— 244
9.7.3	Leather processing in Coventry —— 244
9.8	Further developments in leather processing —— 246
9.8.1	Developments in tanning —— 247
9.8.2	Developments in dyeing —— 248
9.9	Leather processing in Bucharest —— 249
9.10	Concluding remarks —— 250
	References —— 251
Chapter 10	
Ultrasonica	lly assisted biodiesel synthesis —— 257
10.1	An introduction to biofuels —— 257
10.1.1	First-generation biofuels —— 257
10.1.2	Second-generation biofuels —— 257
10.1.3	Third-generation biofuels —— 258
10.2	A general introduction to diesel fuel —— 258
10.3	The history of biodiesel —— 260
10.3.1	The first synthetic biodiesel fuel —— 261

10.3.2	The first reference to the chemical transesterification of a
	glyceride —— 262
10.4	Ultrasonically assisted biodiesel synthesis (UABS) —— 263
10.4.1	The chemistry involved in UABS — 264
10.4.2	Ultrasonically induced oil and methanol emulsification — 267
10.5	The work of Mircea Vinatoru (MV) on Ultrasonically Assisted
	Biodiesel Synthesis (UABS) —— 268
10.5.1	MV and UABS – Japan —— 268
10.5.2	MV and UABS - Romania (Part 1) 278
10.5.3	MV and UABS – Canada —— 279
10.5.4	MV and UABS – Texas —— 280
10.5.5	MV and UABS - Romania (Part 2) 289
10.6	Some comments on the scale-up of UABS for use as an
	agricultural fuel —— 298
10.7	Some comments on UABS production —— 301
	References —— 302

Index ---- 307