

Valve-regulated Lead–Acid Batteries

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Preface

For over a hundred years from its conception, the lead–acid cell was normally operated with unrestricted access between the surface of its electrolyte and the external atmosphere so that, during periods of overcharge, hydrogen and oxygen were lost from the cell via electrolysis. As a result, periodic additions of distilled water were necessary. Since about 1970, an alternative to the traditional ‘flooded’ cell has been available — one that avoids the need for water maintenance. Moreover, acid is immobilized in the new design and this endows the cell with the additional advantages of being ‘spill-proof’ and able to operate in any orientation (upright, on its side, or even upside down).

The change to the so-called ‘valve-regulated lead–acid’ (VRLA) technology has not, however, been accomplished without some difficulty. Experience has demonstrated forcibly the fundamental differences between the two systems, and the lead–acid battery manufacturing industry has faced major challenges in investing the VRLA version with a performance to match that of its flooded predecessor. Nevertheless, research into understanding the electrochemistry, producing improved cell components and optimizing charge strategies has resulted in VRLA batteries becoming well-established and reliable devices. Operators now take advantage of the particular properties of these batteries for the storage of electrical energy in a wide variety of stationary applications.

Much of the recent advancement of VRLA technology has been achieved through a co-operative research effort under the auspices of the Advanced Lead-Acid Battery Consortium (ALABC). The main effort has been directed towards the development of VRLA battery systems for new-generation road transportation — electric and hybrid electric vehicles — that will reduce fuel consumption and lower emissions. The progress gained in this endeavour will ultimately also benefit the enormously important markets in telecommunications and remote-area power supplies.

This volume presents a detailed account of recent advances in the science and technology of VRLA batteries. The expert contributors are from organizations which have either been members of, or contractors to, the ALABC. In editing the contributions, we have aimed to unify the style of the volume as far as possible, but have allowed a little overlap between those chapters where there is a natural interaction between topics. It is hoped that this work will constitute a sound exposition of the present status of VRLA batteries, and will provide a resource that will enable technologists to deliver products with performances that surpass the requirements of the major markets.

We wish to express our special appreciation of the dedication and expert skills of Ms. Rita Spiteri (CSIRO) for producing the complete text for publication and redrafting most of the illustrations.

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Contents

Preface	v
List of Contributors	vii
Abbreviations, Symbols and Units used Repeatedly in text	xix

Chapter 1

The Valve-regulated Battery — A Paradigm Shift in Lead–Acid Technology	1
1.1. Lead–Acid Batteries — A Key Technology for Energy Sustainability	1
1.2. The Lead–Acid Battery	2
1.3. The Valve-regulated Battery	7
1.4. Heat Management in Lead–Acid Batteries	10
1.4.1. Heat generation	10
1.4.2. Heat dissipation	11
1.5. The Challenges Ahead	12
References	14

Chapter 2

Lead Alloys for Valve-regulated Lead–Acid Batteries	15
2.1. Antimony-free Grid Alloys	15
2.2. Pure-lead Positive Grids	15
2.3. Lead–Calcium Alloys	16
2.3.1. Hardening mechanism in lead–calcium alloys	17
2.4. Tin Additions to Pure Lead and Lead–Calcium Alloys	20
2.5. Lead–Calcium–Tin Alloys	21
2.5.1. Grain structure	21
2.5.2. Mechanical properties of cast lead–calcium–tin alloys	22
2.5.3. Aluminium addition	24
2.5.4. Corrosion of lead–calcium–tin alloys	24
2.5.5. Tin effects on conductivity of battery grids	25
2.5.6. Silver additions to lead–calcium–tin alloys	28
2.6. Lead–Antimony–Cadmium Alloys	32
References	32

Chapter 3

Formation of Lead–Acid Batteries and Structure of Positive and Negative Active Masses	37
3.1. Introduction	37
3.1.1. Manufacture of lead–acid battery plates	37
3.1.2. Survey of soaking and formation phenomena	40
3.2. Soaking of Plates	42
3.2.1. Filling VRLA cells with H ₂ SO ₄ solution	42

3.2.2.	Chemical zonal processes during soaking	44
3.2.3.	Soaking of 3BS-cured pastes	46
3.2.4.	Soaking of 4BS-cured pastes	52
3.3.	Formation of Positive Plates	54
3.3.1.	Thermodynamics of formation processes	54
3.3.2.	Reactions during formation of PAM from 3BS-cured pastes	55
3.3.3.	Zonal processes during formation of PAM from 3BS-cured pastes	59
3.3.4.	β -PbO ₂ : α -PbO ₂ ratio and its effect on capacity of positive plates	62
3.3.5.	Structure of PAM	64
3.3.6.	Gel–crystal forms of PbO ₂ particles	66
3.3.7.	Mechanism of formation of PbO ₂ particles	70
3.3.8.	Formation of pore system in PAM and its functions	71
3.3.9.	Influence of basic lead sulfates on cycle-life of positive plates	76
3.3.10.	Formation of plates prepared with 4BS-cured pastes	79
3.3.11.	Influence of current-collector surface on formation of PbSO ₄ crystals at grid–PAM interface	83
3.4.	Formation of Negative Plates	85
3.4.1.	Thermodynamics of formation processes	85
3.4.2.	Reactions during formation of negative plate	86
3.4.3.	Zonal processes	88
3.4.4.	Structure of negative active mass	91
3.4.5.	Evolution of pore structure of plate during formation	94
3.4.6.	Effect of expanders on NAM	96
3.4.7.	Effect of expander structure on battery performance	99
3.5.	Technology of Formation	100
3.5.1.	Technological parameters of formation process	100
3.5.2.	Stages of formation of positive and negative plates	100
3.5.3.	General current (voltage) algorithm for formation of positive plates	103
3.6.	Conclusions	106
	References	107

Chapter 4

Positive-Plate Additives to Enhance Formation and Battery Performance		109
4.1.	Introduction	109
4.2.	Modelling the Effects of Additives	109
4.3.	Non-conductive Additives	111
4.3.1.	Hollow glass microspheres	111
4.3.2.	Carboxymethyl cellulose	112
4.3.3.	Silica gel	113
4.3.4.	Designer additives	113

4.4.	Conductive Additives	114
4.4.1.	Barium plumbate	115
4.4.2.	Titanium oxide	118
4.4.3.	Conductive polymers	119
4.4.4.	SnO ₂	120
4.4.5.	Iron boride	120
4.4.6.	Lead-coated glass wire	120
4.4.7.	Carbon	121
4.4.8.	Lead dioxide	123
4.5.	Chemically Active Additives	124
4.5.1.	Sulfate salts	124
4.5.2.	Phosphates	127
4.5.3.	Bismuth	130
4.5.4.	Polyvinylsulfonic acid and its salts	131
4.6.	Conclusions	131
	References	132

Chapter 5

	Negative Plates in Valve-regulated Lead–Acid Batteries	135
5.1.	Introduction	135
5.2.	Basic Electrochemical Characteristics	136
5.3.	Negative-plate Additives	142
5.3.1.	Carbon	144
5.3.2.	Barium sulfate	146
5.3.3.	Organic additives	147
5.4.	Charging Influences	154
5.5.	Use of Internal Catalysts	157
5.6.	Summary	159
	References	160

Chapter 6

	The Function of the Separator in the Valve-regulated Lead–Acid Battery	163
6.1.	Introduction	163
6.2.	Characteristics of Absorptive Glass Mat (AGM)	164
6.2.1.	Wetting behaviour of AGM materials	164
6.2.2.	Physical properties of AGM materials	171
6.3.	Gel Batteries	173
6.4.	Separator Properties and Function	174
6.4.1.	Compression characteristics	174
6.4.2.	Oxygen cycle and recombination efficiency	176
6.4.3.	Stratification and drainage	178
6.5.	Future Developments	179
	References	180

Chapter 7

Separator Materials for Valve-regulated Lead–Acid Batteries	183
7.1. Introduction	183
7.2. State-of-the-art Separators	183
7.2.1. Absorptive glass mat (AGM) separators	183
7.2.2. Separators for gel batteries	185
7.3. Development Trends for VRLA Battery Separators	186
7.4. Separator Developments	187
7.4.1. Modified AGM	187
7.4.1.1. AGM — high surface-area	187
7.4.1.2. AGM — high low surface-area composite	190
7.4.1.3. AGM — membrane sandwich	191
7.4.1.4. AGM — with organic fibres	191
7.4.1.5. Silica-loaded glass mat (SLGM)	193
7.4.1.6. Other AGM modifications	194
7.4.2. Alternative separators	195
7.4.2.1. Synthetic wood-pulp separators (SWP)	195
7.4.2.2. Polymeric microfibre mat	197
7.4.2.3. Staflex	197
7.4.2.4. Acid jellying separator	199
7.4.2.5. Ceramic separator	201
7.4.2.6. Granular silica	203
7.5. Conclusions	203
References	204

Chapter 8

Battery Management	207
8.1. Introduction	207
8.2. Tasks of Battery Management Systems	208
8.3. Designs of Battery Management System	209
8.4. Battery Data Acquisition	210
8.5. Determination of Battery State	212
8.5.1. Battery state-of-charge	213
8.5.2. Battery state-of-health	225
8.6. Electrical Management of Batteries	229
8.6.1. Control of charge	229
8.6.2. Control of discharge	229
8.6.3. Multiple battery systems	231
8.7. Thermal Management of Batteries	233
8.7.1. Air systems	233
8.7.2. Liquid systems	234
8.7.3. Electrical systems	235
8.7.4. Passive cooling systems and isolation	236
8.7.5. Phase-change materials	237

8.7.6.	Other systems	237
8.8.	Storage of Historical Battery Data	237
8.9.	Safety Management of Batteries	238
8.10.	System Communications	238
8.11.	Conclusions	239
	References	239

Chapter 9

Charging Techniques for VRLA Batteries		241
9.1.	Introduction	241
9.1.1.	Basic charging — chemistry/secondary reactions	242
9.1.2.	Traditional charging methods	245
9.1.2.1.	Constant-voltage charging	245
9.1.2.2.	Constant-current charging	247
9.1.2.3.	Constant voltage–constant current combinations	249
9.1.2.4.	Taper-current charging	251
9.1.2.5.	Pulsed-current charging	253
9.2.	Charging of VRLA Products	254
9.2.1.	The oxygen cycle and saturation effects	254
9.2.2.	Gas transport and oxygen cycle	257
9.2.3.	Overcharge processes	259
9.3.	Existing Charging Methods Applied to VRLA Products	262
9.3.1.	Float charging	262
9.3.2.	Cyclic charging	267
9.3.3.	Fast charging	271
9.3.4.	Charge-termination strategies	272
9.3.5.	Failure modes attributable to charging	274
9.4.	Evolving and Optimized Charging Methods	276
9.4.1.	Optimized approaches to float charging	276
9.4.2.	Optimized approaches to cyclic charging	279
9.4.3.	Partial-state-of-charge cycling — an evolving algorithm	285
9.5.	Summary and Conclusions	288
	References	291

Chapter 10

Battery Energy-Storage Systems for Power-Supply Networks		295
10.1.	Introduction	295
10.2.	A Historical Perspective	295
10.3.	Energy-Storage Technologies	297
10.3.1.	Lead–acid (and advanced) batteries	301
10.3.2.	Supercapacitors	301
10.3.3.	Flywheels	302
10.3.4.	Superconducting magnetic energy storage	302
10.4.	Energy-storage Applications	302

10.4.1.	Rapid reserve (generation)	304
10.4.2.	Area control and frequency responsive reserve (generation)	304
10.4.3.	Commodity storage (generation)	305
10.4.4.	Transmission system stability (T&D)	305
10.4.5.	Transmission voltage regulation (T&D)	305
10.4.6.	Transmission facility deferral (T&D)	305
10.4.7.	Distribution facility deferral (T&D)	305
10.4.8.	Renewable energy management (customer service)	306
10.4.9.	Customer energy management (customer service)	306
10.4.10.	Power quality and reliability (customer service)	306
10.5.	Battery Energy-storage Systems	306
10.5.1.	Elektrizitätswerk Hammermuehle, Germany	306
10.5.2.	BEWAG AG, Berlin, Germany	308
10.5.3.	Hagen Batterie AG, Soest, Germany	309
10.5.4.	Crescent Electric Membership Corporation, Statesville, NC, USA	309
10.5.5.	Southern California Edison, Chino, CA, USA	310
10.5.6.	Johnson Controls, Inc., Milwaukee, WI, USA	311
10.5.7.	Puerto Rico Electric Power Authority	312
10.5.8.	GNB Technologies, Vernon, CA, USA	313
10.5.9.	Metlakatla, AK, USA	314
10.5.10.	Herne and Bochold, Germany	315
10.5.11.	PQ2000	316
10.6.	Power Conversion	317
10.6.1.	Basic concepts	318
10.6.2.	Switch considerations	321
10.6.3.	Performance issues	321
10.7.	Cost Considerations	322
10.8.	Concluding Remarks	323
	References	325

Chapter 11

	Valve-regulated Lead–Acid Batteries in Automotive Applications — A Vehicle Manufacturer’s Perspective	327
11.1.	Introduction	327
11.1.1.	Battery selection process	328
11.1.2.	Sub-system description	334
11.1.3.	Initial design phase	334
11.1.4.	Failure modes and effects analysis	337
11.1.5.	Design validation plan	337
11.1.6.	Future electric loads	337
11.1.7.	Environmental	342
11.1.8.	Cost	343

11.1.9.	Reliability	344
11.1.10.	Safety	346
11.1.11.	Maintenance-free	346
11.1.12.	Weight savings	347
11.2.	VRLA in Automotive Applications	347
11.2.1.	VRLA features of interest to the automotive industry	348
11.2.2.	Continuum of electric drive	351
11.3.	Automotive Applications	353
11.3.1.	12-V automotive	353
11.3.1.1.	Performance requirements	356
11.3.1.2.	Controls and diagnostics for 12-V automotive batteries	360
11.3.1.3.	VRLA as a 12-V automotive battery	361
11.3.2.	42-V automotive	363
11.3.2.1.	General requirements	365
11.3.2.2.	Controls and diagnostics for 42-V automotive batteries	367
11.3.2.3.	VRLA as 42-V automotive battery	368
11.3.3.	Soft hybrids	369
11.3.3.1.	General requirements	370
11.3.3.2.	Controls and diagnostics for soft hybrid batteries	375
11.3.3.3.	VRLA as a soft hybrid battery	376
11.3.3.4.	Low initial cost of VRLA	378
11.3.4.	Parallel-series hybrids	378
11.3.4.1.	General requirements	380
11.3.4.2.	Controls and diagnostics for parallel-series hybrid vehicles	382
11.3.4.3.	VRLA as a parallel-series hybrid battery	383
11.3.5.	Electric vehicles	385
11.3.5.1.	Performance requirements	388
11.3.5.2.	Controls and diagnostics for EVs	391
11.3.5.3.	VRLA as an EV battery	394
11.4.	Conclusions	396
	References	396

Chapter 12

Valve-regulated Lead-Acid Batteries in Automotive Applications — A Battery Manufacturer's Perspective		397
12.1.	Introduction	397
12.2.	History of Automotive Batteries and Vehicle Electrical Systems	401
12.2.1.	The beginning	401
12.2.2.	Development of vehicle electrical power systems and automotive batteries in 20th century	401

12.2.3.	Expected changes in vehicle electrical systems in next decade and corresponding demands on automotive batteries	407
12.3.	Design, Components, Manufacturing of Automotive Batteries	409
12.3.1.	Components	409
12.3.2.	Special designs/special applications	409
12.3.3.	Plate arrangement — plate stacking and spiral winding	410
12.3.4.	AGM and gel technology in vehicles	413
12.3.5.	VRLA automotive 12-V batteries for standard vehicle electrical systems	414
12.3.6.	36-V VRLA automotive batteries for 42-V PowerNets	415
12.4.	The VRLA Battery in Automotive Applications and its Interaction with the Vehicle	417
12.4.1.	VRLA batteries in present vehicle electric systems	417
12.4.2.	VRLA batteries in vehicles with new components and new operating strategies	420
12.4.3.	State-detection and management of VRLA batteries	426
12.5.	Performance Data	427
12.6.	Outlook	427
	References	430

Chapter 13

	Valve-regulated Lead–Acid Batteries for Telecommunications and UPS Applications	435
13.1.	Introduction	435
13.2.	Features of VRLA Technology	436
13.2.1.	Positive-grid corrosion	436
13.2.2.	Improvement of service-life	440
13.3.	Gel Batteries	446
13.4.	AGM Batteries	451
13.5.	Large Batteries for Stationary Applications	455
13.6.	Future Trends in Stand-by Batteries	459
13.6.1.	Continuous plate-processing	459
13.6.2.	Spiral technology	461
13.6.3.	Advanced separators	462
13.7.	Conclusions	462
	References	463

Chapter 14

	Remote-area Power-supply (RAPS) Systems and the Valve-regulated Lead–Acid Battery	467
14.1.	The Need for Remote-area Power-supply Systems	467
14.2.	RAPS System Components	467

14.2.1.	Battery bank	468
14.2.2.	Diesel generator	469
14.2.3.	Photovoltaic array	469
14.2.4.	Wind generator	470
14.2.5.	Hydro-generator	470
14.2.6.	Inverter	471
14.2.7.	Control system	472
14.3.	RAPS System Design	472
14.3.1.	Direct-current RAPS systems	473
14.3.2.	Alternating-current RAPS systems	474
14.4.	VRLA Batteries for RAPS Systems	476
14.4.1.	Advantages	476
14.4.2.	Disadvantages	477
14.4.3.	Failure modes	478
	14.4.3.1. Overcharging	479
	14.4.3.2. Undercharging	480
	14.4.3.3. Temperature extremes	481
	14.4.3.4. Deep-cycle operation	482
14.4.4.	Preferred design features	482
	14.4.4.1. Purpose-built batteries	482
	14.4.4.2. Lower-cost batteries	483
14.4.5.	Recent developments	484
14.4.6.	Advanced operating strategies	484
	References	489

Chapter 15

Recovery and Recycling of Lead–Acid Batteries	491	
15.1.	Introduction	491
15.2.	Battery Collection and Processing	492
	15.2.1. Battery collection	492
	15.2.2. Battery processing	493
15.3.	Recovery and Refining	496
	15.3.1. Pyrometallurgical methods	496
	15.3.2. Hydrometallurgical methods	503
	15.3.3. Refining and alloying of lead	503
	15.3.3.1. Fine refining	504
	15.3.3.2. Electrolytic refining	507
15.4.	Challenges Facing the Secondary Lead Industry	508
	15.4.1. Processing and recovery	508
	15.4.2. Refining	509
	15.4.3. Silver	509
	15.4.4. Antimony	510
	15.4.5. Catalyst elements	510
	15.4.6. Other elements	511
	References	511

Chapter 16

Environmental Aspects of Recycling Valve-regulated Lead–Acid Batteries	513
16.1. Introduction	513
16.2. Justification for Recycling	514
16.3. Recycling Rates	515
16.4. Collection of Used VRLA Batteries	515
16.5. Transport of Used VRLA Batteries	517
16.6. Recycling Process	519
16.7. Recycling Options	522
16.8. Monitoring and Controlling Emissions	526
16.9. Engineering Control in the Workplace	527
16.10. Process Emission Controls	528
16.11. Emission Testing and Analysis	529
16.12. Biological Monitoring	532
16.13. Respiratory Protection	534
16.14. Employees' Amenities	537
16.14.1. Location	537
16.14.2. Segregation	538
16.14.3. Containment	538
16.15. Effluent Control	539
16.16. International Conventions and Protocols	543
16.16.1. Basel Convention	543
References	547

Chapter 17

The Next Great Challenge for Valve-regulated Lead–Acid Batteries: High-rate Partial-state-of-charge Duty in New-generation Road Vehicles	549
17.1. Future Automobile Electrical Systems	549
17.2. The Challenge of High-rate Partial-state-of-charge (HRPSoC) Duty	550
17.3. Mechanism of Lead Sulfate Accumulation During HRPSoC Duty	554
17.4. Controlling Secondary Reactions During High-rate Charge	559
17.4.1. Trace element control	559
17.4.2. Separator design	559
17.4.3. Carbon inventory	559
17.5. Grid Design for HRPSoC Duty	560
17.6. The Role of Plate Thickness	562
17.7. Concluding Remarks	564
References	565

Subject Index	567
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