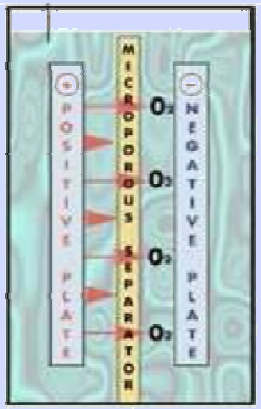
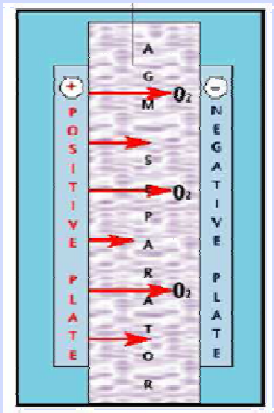
Comparison

AGM - GEL

ENERGY FROM BATTERIES

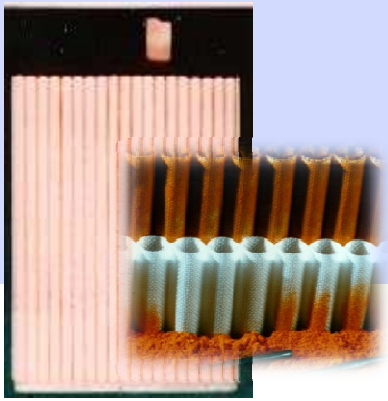
BAE

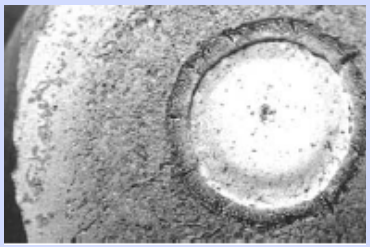
Comparison AGM - GEL

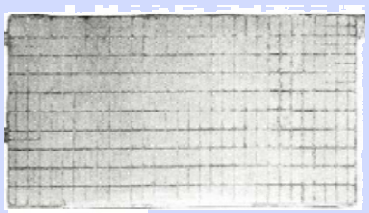
GEL	AGM
VRLA Lead Acid Battery **Grid plate / tubular plate** – Electrolyte fixed in fumed silica as GEL	**VRLA** Lead Acid Battery **Grid plate** –Electrolyte fixed absorbed glass matt
	
• GEL wetted plates completely incl. flags and bridges – Acid surplus → ***Capacity*** – Temperature behavior → ***Consistent***	• Glass matt only between plates; stops beyond the pole bridges – Reaction surface is limited to the wetted area → ***Capacity loss*** – Temperature behavior → ***Worse*** – Acid stratification → ***Capacity/charging***

Comparison AGM - GEL

BAE OPzV	AGM
Tubular plate	**Grid plate**
Gauntlet encase active mass - No shedding - Big mass reserve → ***Cyclic stable, long life duration***	Mass pasted into grid - Shedding easier possible - Due to low height limited mud space → ***Hazard of short circuits***
Centered lead sole with big cross section – Corrosion resistant	Thin plates - Limited mass per plate → ***No cyclic stability*** → ***Limited capacity***
Homogeneous allocation of active mass – High capacity – Consistent quality	





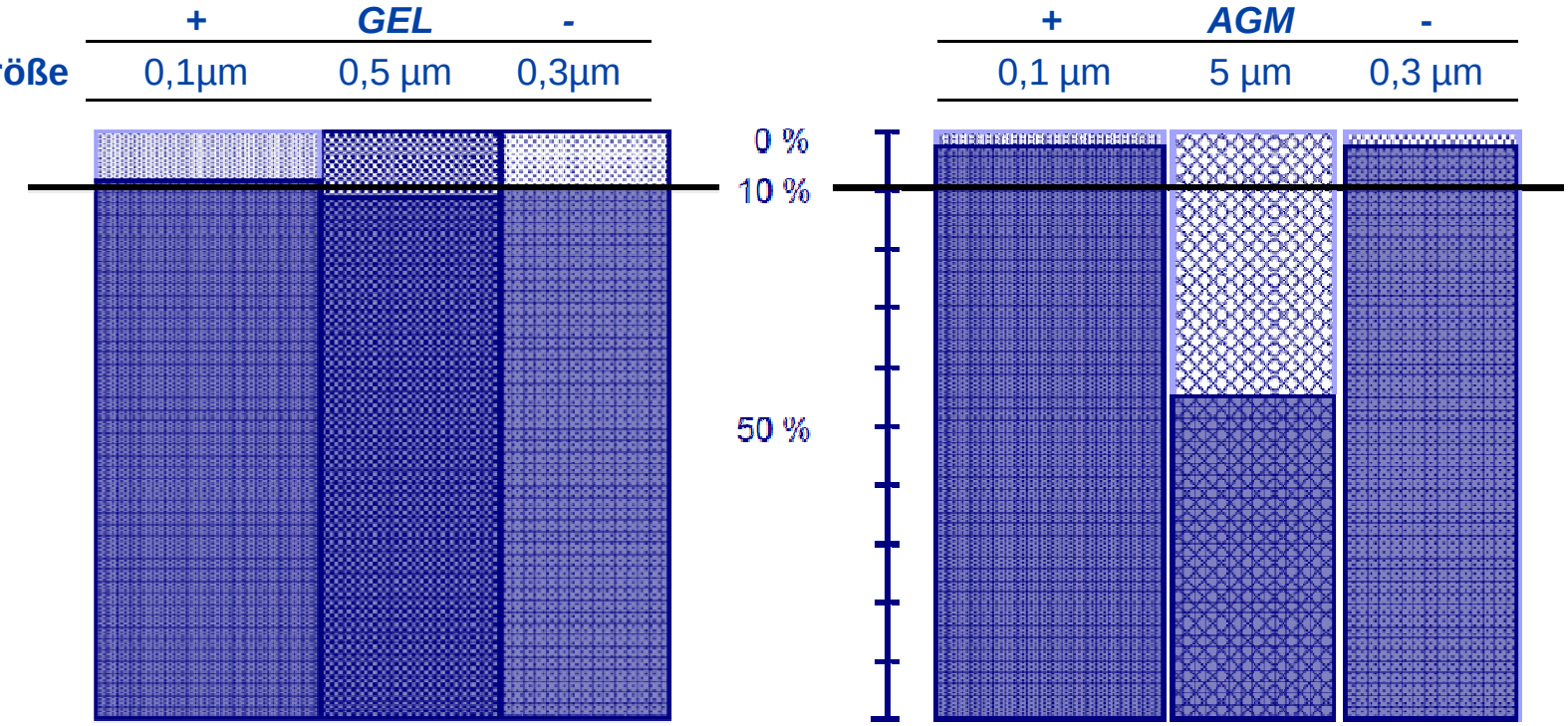


Comparison AGM - GEL

GEL (OPzV)	Fleece (AGM)
Pore size: 0,1µm to 1µm • Same pore size as active mass → ***Better fixing of acid, strong reduced water consumption***	**Pore size:** 1 µm to 10 µm • 10 times bigger than in GEL → ***Weak fixing of acid*** → ***Higher water consumption*** → ***Thermal Runaway*** → ***Acid stratification***
• Fills the complete container → ***Better contact to both plates until end of life*** → ***Consistent capacity***	• Only limited flexible → ***Contact loss to active materials after 50% life time*** → ***Capacity loss***
• Wetted flags and pole bridges	• Only between neg. und pos. plate → ***Dry flags and pole bridges***
• Microporous separator → ***Small pores*** → ***Protection against dendrites*** → ***Deep discharge safe*** → ***No short circuits between plates***	• Glass matt works at separator at the same time → ***Advantage: 10% less internal resistant at initial life time*** **BUT**: Increases permanently due to high water consumption leads into capacity loss and again to higher internal resistance → ***Not deep discharge safe***

Comparison AGM - GEL

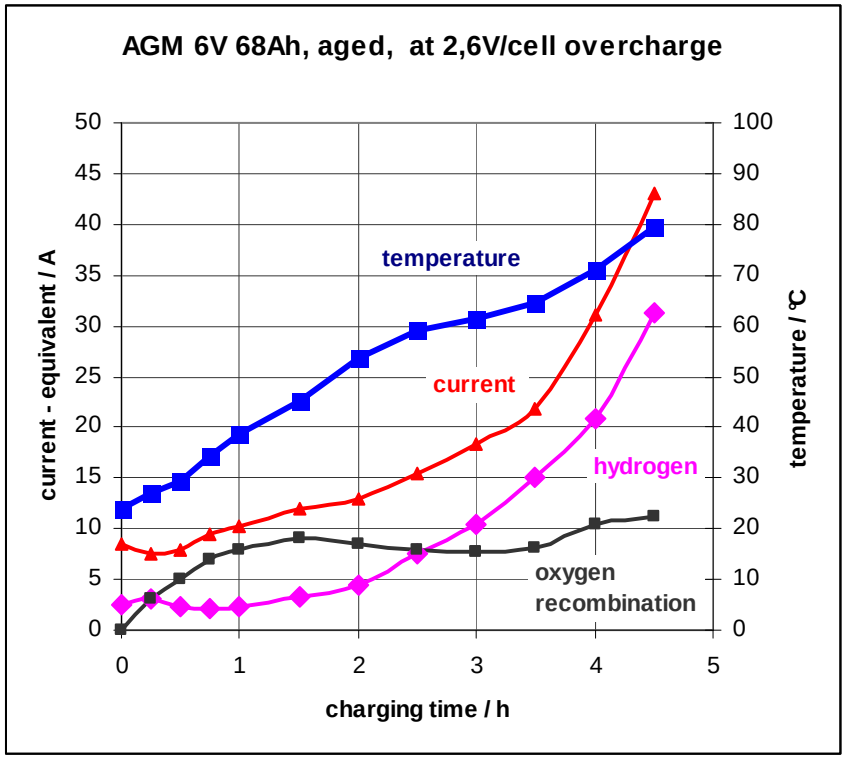
Acid location within the cell after 10% water loss

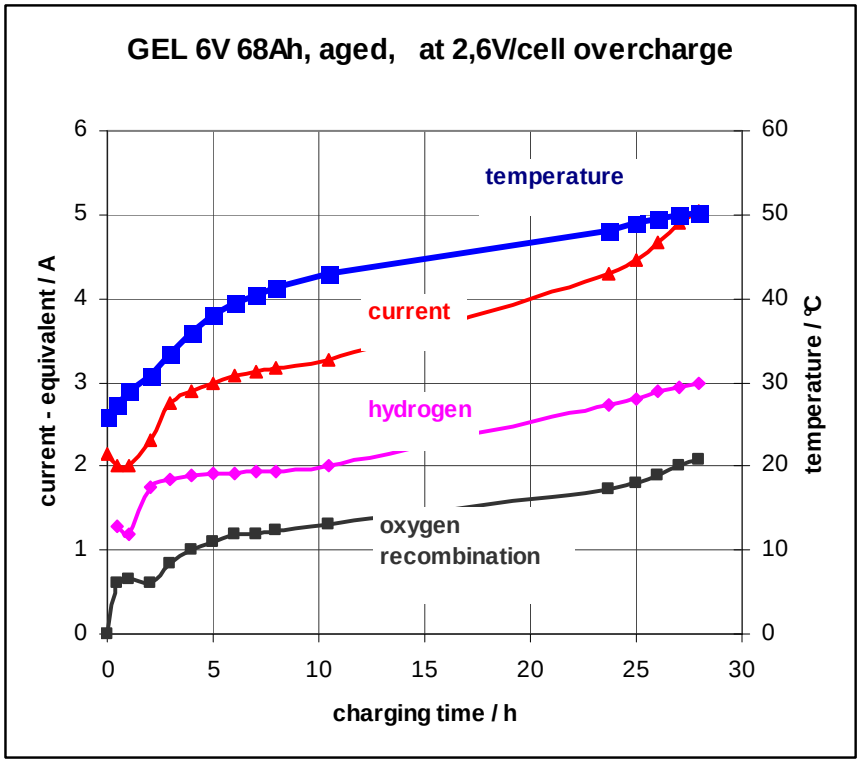


	AGM	GEL
Internal resistance new	1,4 mΩ	1,55 mΩ
Internal resistance after 10% water loss	2,4 mΩ	1,65 mΩ

Comparison AGM - GEL

Thermal runaway simulation





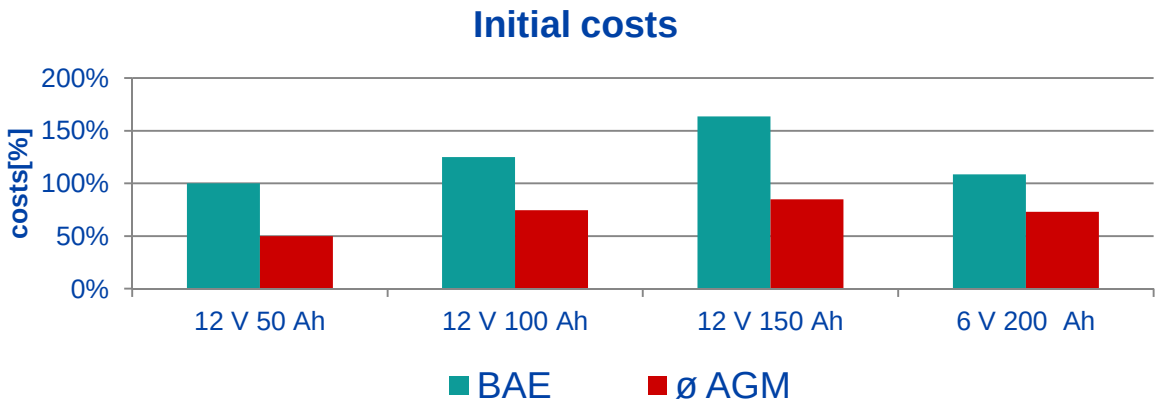
Comparison AGM - GEL

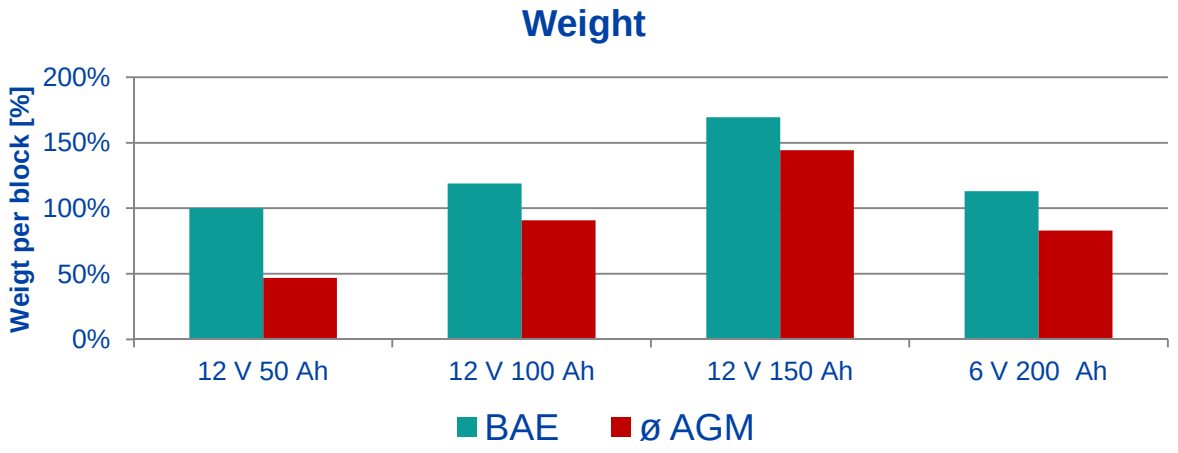
Comparable block types

	Capacity C10 Ue: 1.80 V/cell		Price		Weight		Design Life in years		Design Life in cycles	
	BAE	Ø AGM	BAE	Ø AGM	BAE	Ø AGM	BAE	Ø AGM	BAE	Ø AGM
12 V 50 Ah	57,3	48,50	100 %	50%	42,50	19,90	18	8	1500	700
12 V 100 Ah	109	98,00	100 %	75%	50,50	38,55	18	8	1500	700
12 V 150 Ah	165	151,00	100 %	75 %	72,00	61,30	18	8	1500	700
6 V 200 Ah	229	205,00	100 %	73%	48,00	35,25	18	8	1500	700

Comparison AGM - GEL

Comparable block types

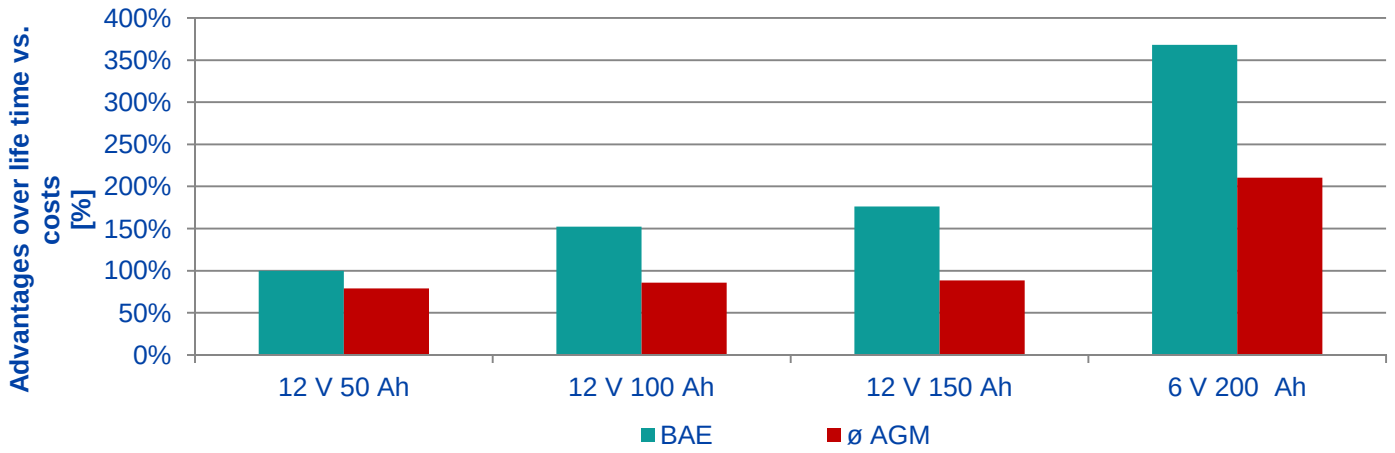




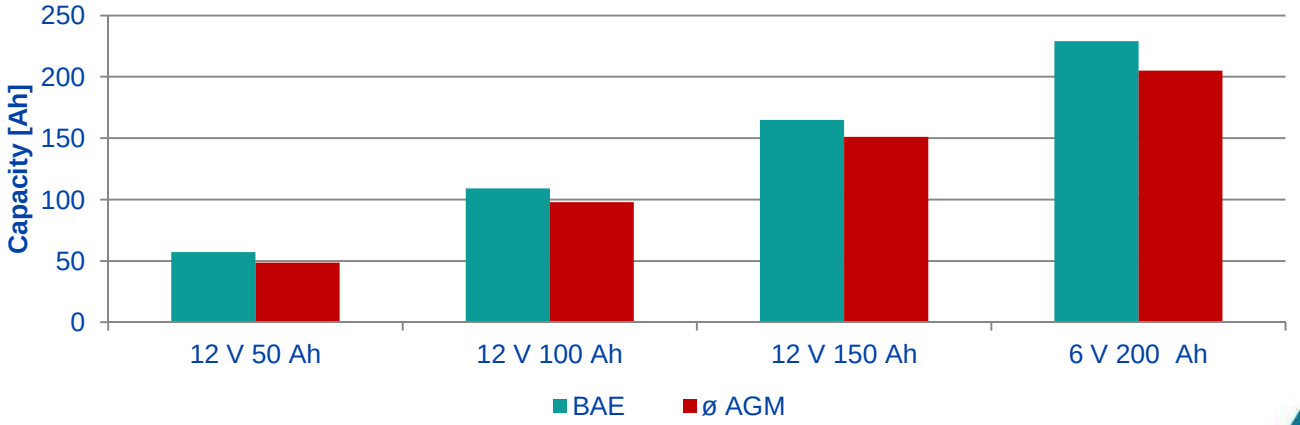
Comparison AGM - GEL

Comparable block types

Complete cycle life vs. costs



capacity C10

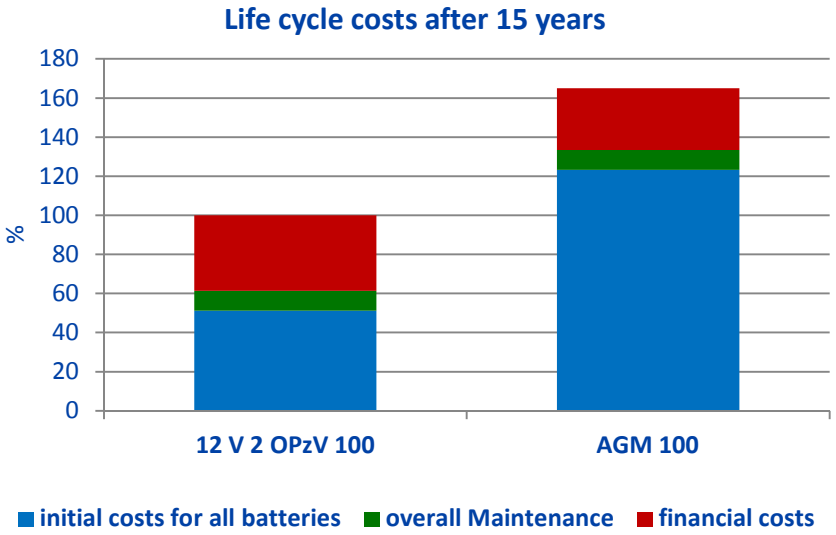


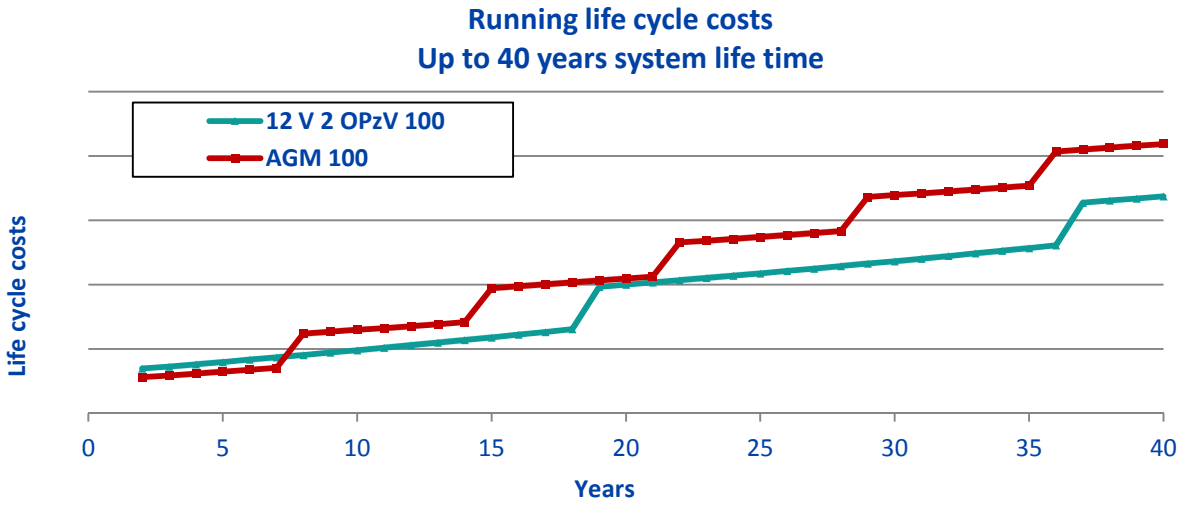
ENERGY FROM BATTERIES

BAE

Comparison AGM - GEL

Life cycle costs	BAE OPzV		AGM	
Number of cells	24			
Expected life time of whole system	20 years			
General Information				
Interest rate	same			
Purchasing overall effort	same			
Transport	same			
Maintenance effort per cell	same			
Maintenance intervalls per year	same			
Battery data				
Initial costs per block	100	%	80	%
Real life time of system	15	years	7	years





ENERGY FROM BATTERIES

BAE

Summary Comparison AGM - GEL

	BAE OPzV	AGM
IEC cycles	>1500 cycles	~700
Design life	Cell: 20 years Block: 18 years	Ø 13 years
float voltage per cell	2,23V	Ø 2,27 V
Needed space	Higher	Low
Weight	High	Low
Initial costs	100 %	~ Ø 70 %
Cycle stability	Very well, no acid	Bad
Deep discharge	No dendrites due to double separation with small pores	Dendrites possible
Thermal Runaway	avoided, diffusion of oxygen during recombination strongly limited	Possible by bad conditions of high rate of oxygen recombination
Capacity stability over life time	Very good Iinternal resistant increases very slow; no contact loss between acid and mass	medium Internal resistant increases much faster than in GEL with faster process of drying; contact loss when glass mat dry

Summary comparison