



LIGHTWEIGHT POSITIVE PLATE

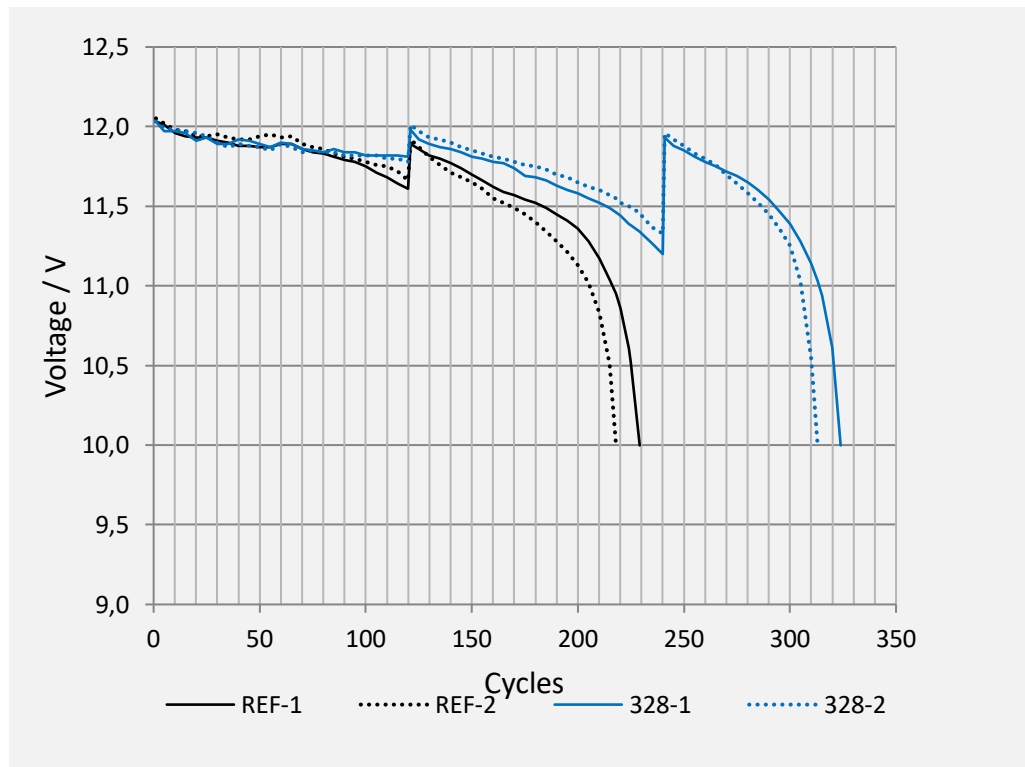
Save Lead with DYNAGRID® NG New

IEES Study of Cycle Lifetime Extension of SLI Batteries

What it is	How it works	Benefits
<ul style="list-style-type: none">» Cellulose fibers	<ul style="list-style-type: none">» Cellulose dissolves» Synthetic veil remains on plate surface	<ul style="list-style-type: none">» Less shedding during cycling» Protection against vibration and shock
<ul style="list-style-type: none">» Acid resistant fibers	<ul style="list-style-type: none">» Dynagrid® NG Protects integrity of active mass	<ul style="list-style-type: none">» Longer Battery Life



IEES Study of Cycle Lifetime Extension of SLI Batteries



	REF 1	REF 2	NG 328 1	NG 328 2
N(max)	229	218	324	313
N(ave)		224		319
%		--		42 %

THE LIGHTWEIGHT POSITIVE PLATE CONCEPT

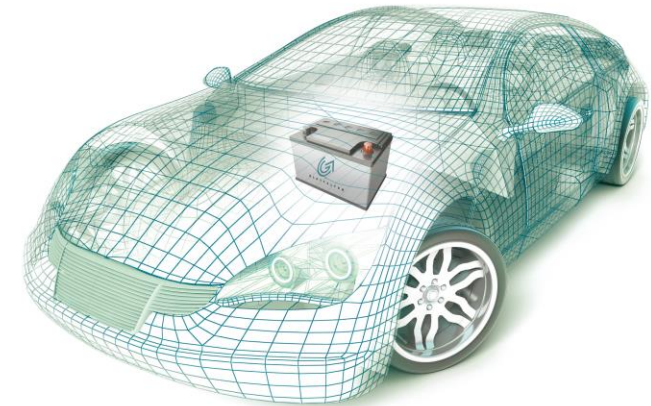
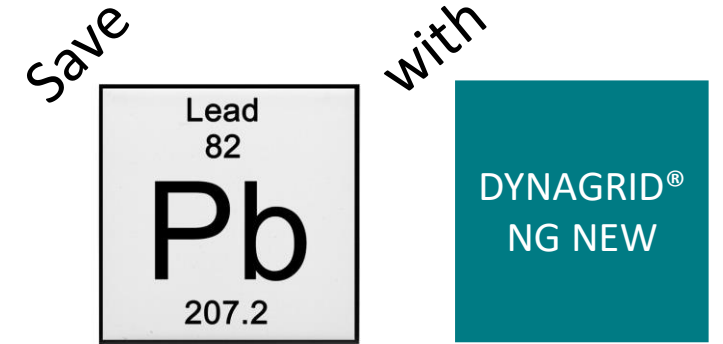
In Cooperation with Moll Batterien GmbH, Germany

The Idea

- The Lightweight Positive Plate Concept is a proposal to **save Positive Active Mass (PAM)** by paste optimization in conjunction with the introduction of the **DYNAGRID® NG NEW** pasting scrim for mechanical protection.
- Our estimate is that savings of appr. 200 T€ per 1 Mio. produced batteries are achievable.

The Approach

- Reduce the positive active mass of an SLI lead acid battery.
- Increasing the utilization factor of the active mass to maintain the capacity (optimized paste).
- Stabilize the weaker PAM by using **Dynagrid® NG NEW** instead of standard pasting paper.
- Prove that the battery performance is not compromised.



A Proof-of-Concept Study was conducted to verify that the approach is valid.

THE PROOF OF CONCEPT STUDY

Experimental Procedure

- The plates were manually pasted in the lab of a battery producer.
- The following positive plates were produced:
 - Reference with standard weight and standard pasting paper
 - Reference with standard weight and DYNAGRID® NG
 - Optimized paste with 5% reduced PAM and standard pasting paper
 - Optimized paste with 5% reduced PAM and DYNAGRID® NG
 - Optimized paste with 5% reduced PAM and DYNAGRID® NG NEW
- Cell design is 7+ / 7- with 65 Ah nominal capacity
- Other studies have proven that the performance of the test cell is comparable to the corresponding battery [1][2]

The target is to prove that weight reduction doesn't lead to poorer performance when applying DYNAGRID® NG NEW for mechanical protection.

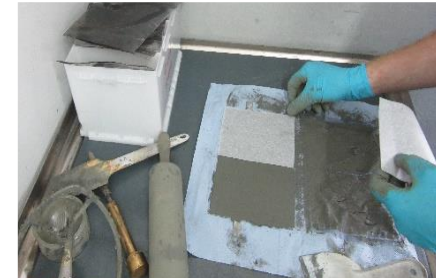
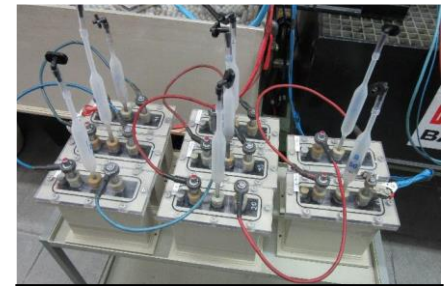


Plate Manufacturing



Cell Build & Assembly



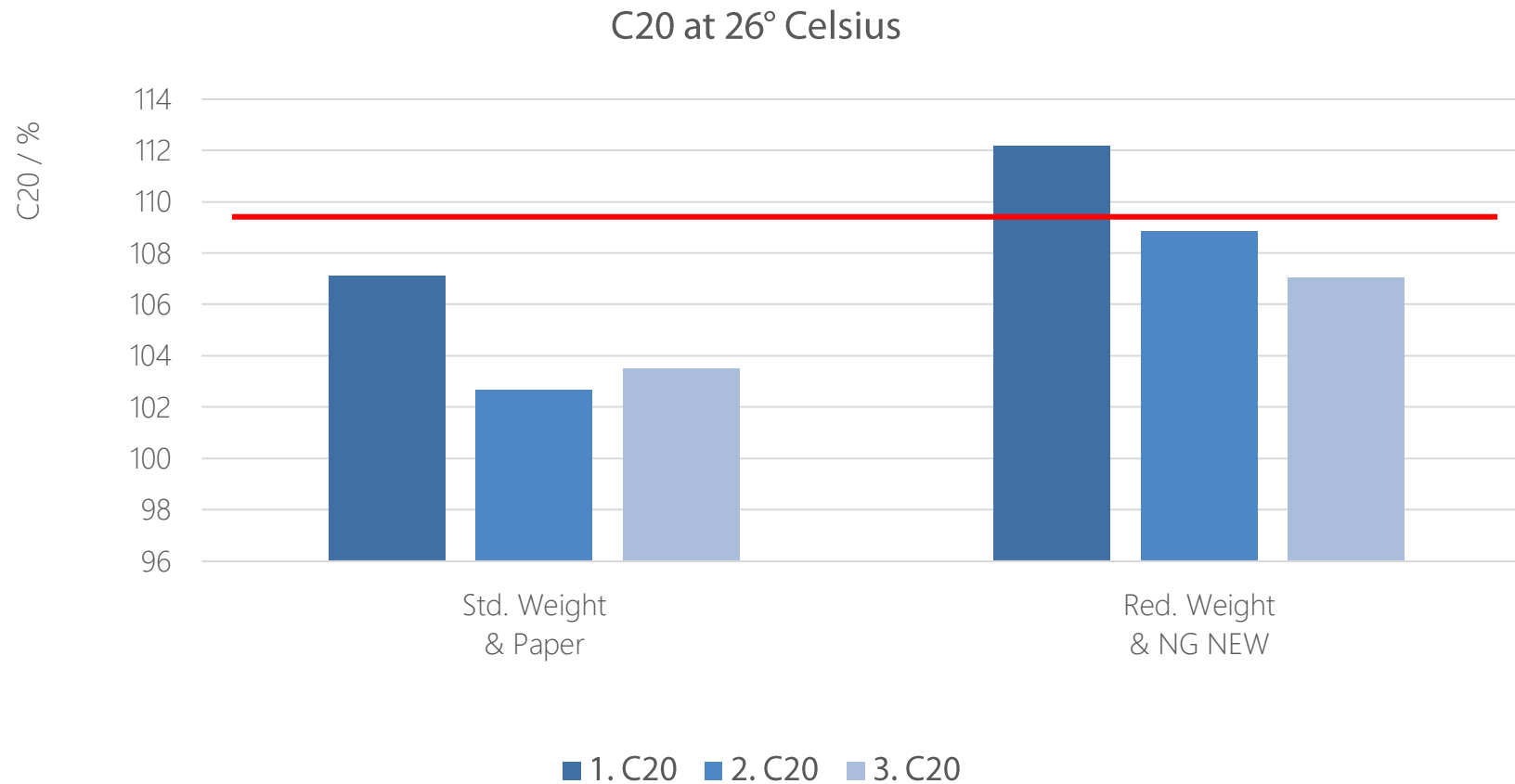
Formation & Cycling

TEST PROTOCOL

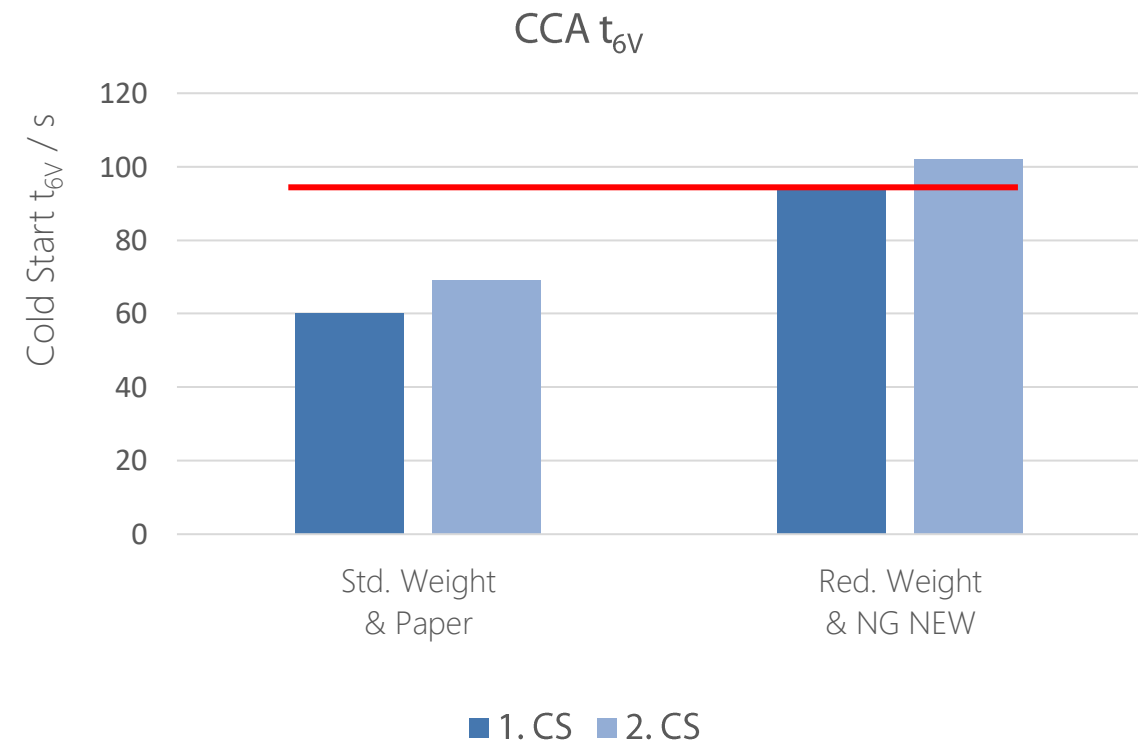
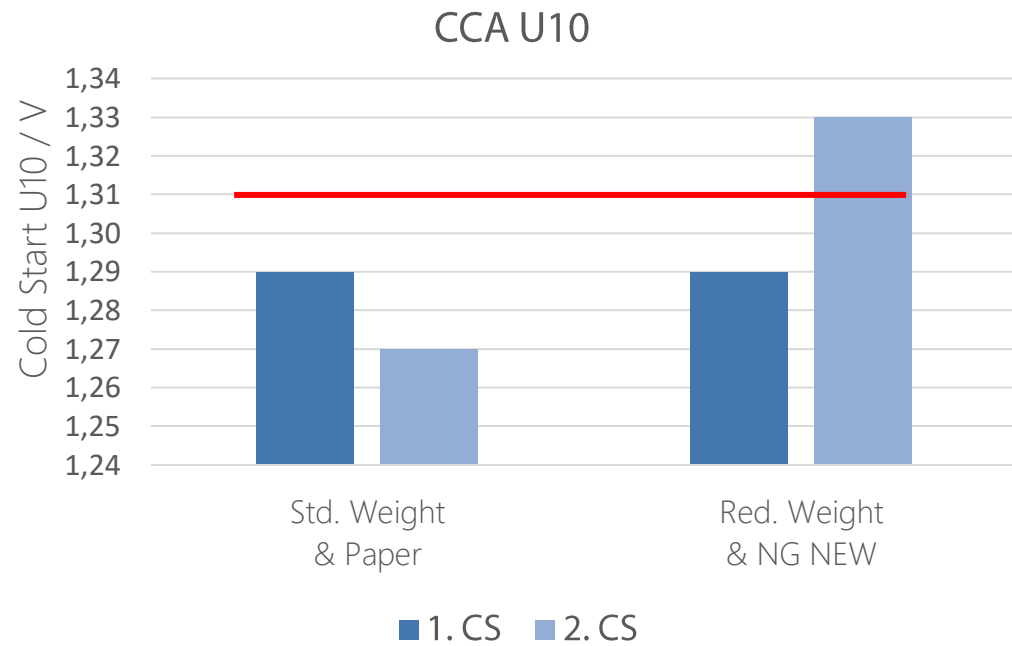
- Following tests were applied:
- Discharge current for Capacity (C20)
- Cold cranking – CCA U10 discharge current (EN current)
- Cold cranking - CC t_{6V} (DIN current)
- Lifetime test - Charge/Discharge current cycling test 50% DOD



CAPACITY TEST AT 26° CELSIUS

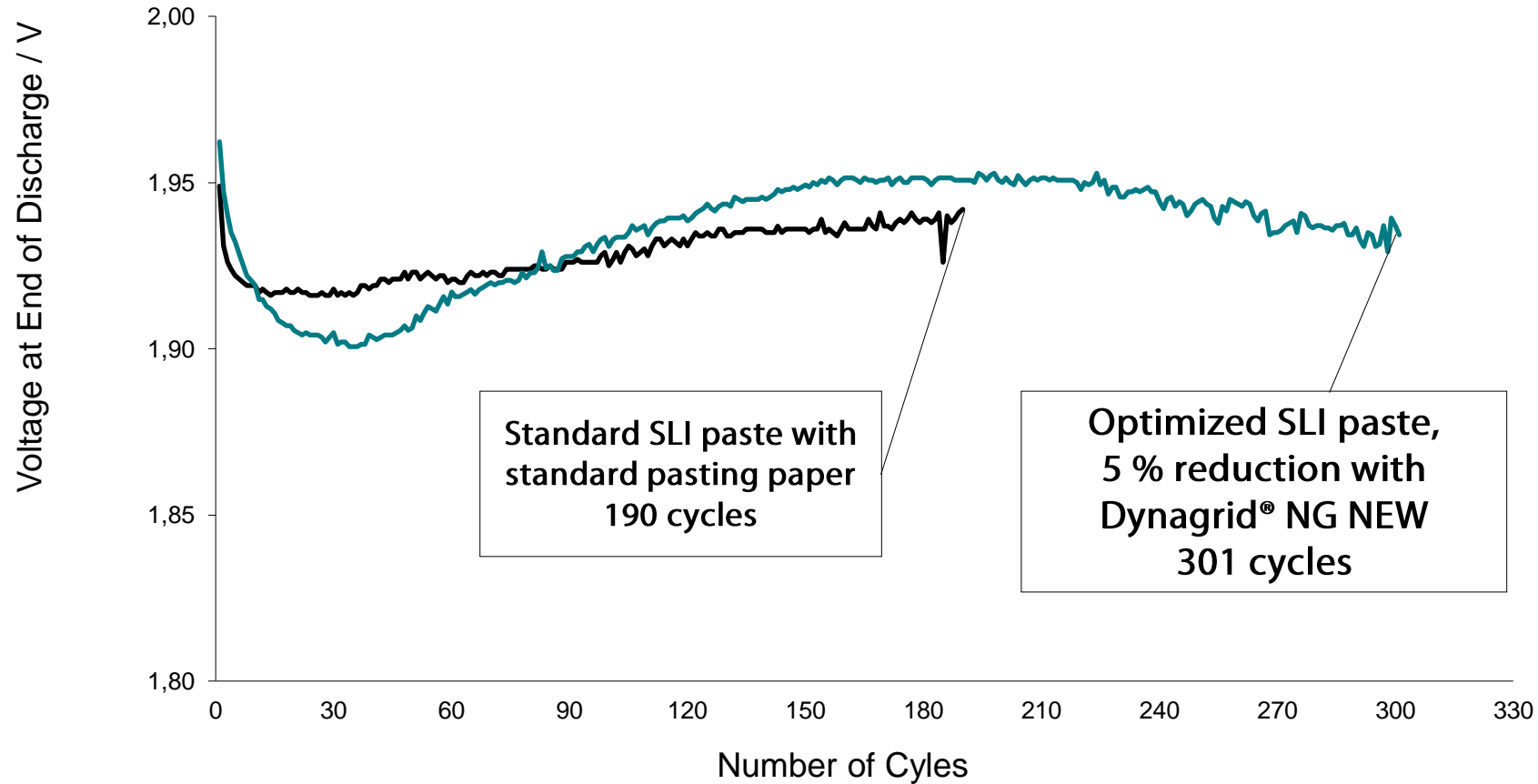


CCA TESTS



CYCLING TEST – 50% DOD AT 40° CELSIUS

Cycling Tests - 50% DOD



- The graph on the left shows the sequence in which the test cells dropped out. **Optimized standard SLI paste with 5% reduced Weight & NG NEW** reached the highest cycle number.
- In order to interpret the results of the test properly, a **cell autopsy** was carried out after cycling.
- For the cells, **mossing** was the reason for the termination of the cycling tests.

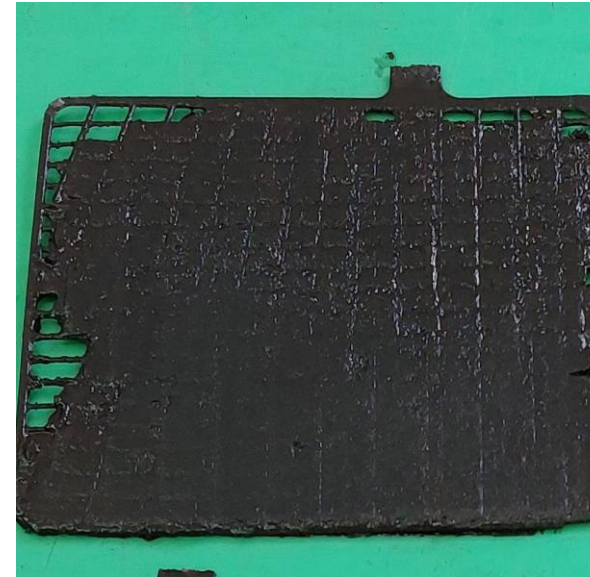
CONDITION OF THE POSITIVE PLATES AFTER CYCLING

Standard SLI paste with standard pasting paper



- After 190 cycles
- Very solid core
- Intact surface
- In excellent condition
- Could cycle much longer
- Early termination due to an early short circuit by mousing

Optimized SLI paste, 5 % reduction with Dynagrid® NG NEW



- After 301 cycles
- Soft core
- Smearable surface
- In poor condition
- Close to end of cycle lifetime

COMMERCIAL POTENTIAL

Calculation of Saving Potential

Battery type	SLI
Capacity	70 Ah

Assumptions

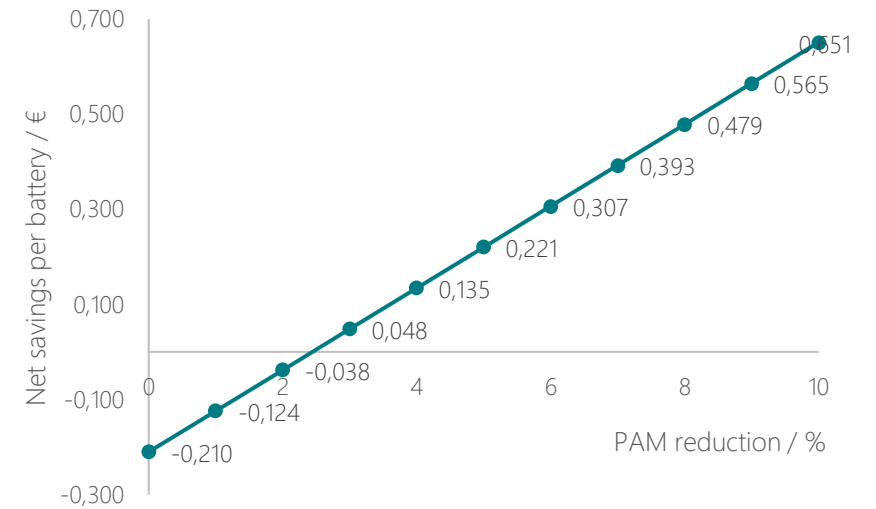
Price of Lead Oxide	2.5 €/kg
Cost of standard pasting 313	5.5 €/kg
Price of Dynagrid® NG328	9.50 €/kg
Paper on positive plate required per battery	1.00 m ²
Basis weight of DYNAGRID NG	28 g/m ²
Utilization factor	56%

Calculations

Theoretical weight of PAM	4.46 g / (Ah)
Actual weight of PAM per Ah, accounted for utilization factor	7.97 g / (Ah)
Weight of PAM per cell (72 Ah battery)	558 g
Total PAM per battery (6 cells)	3347 g
Extra cost for NG compared to Standard 313	0.20 € per battery
Cost of lead oxide for PAM	8.37 € per battery
Achievable reduction of PAM	5%
Gross PAM savings	0.42 € per battery
Net savings per battery	0.22 € per battery

Total savings per 1 Mio batteries 221156 €

Net savings per battery / €



SUMMARY – LIGHTWEIGHT POSITIVE PLATE

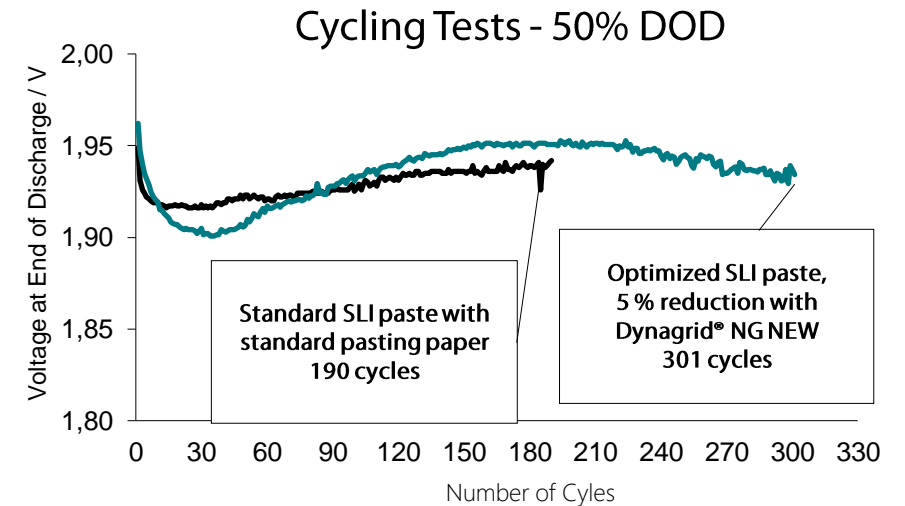
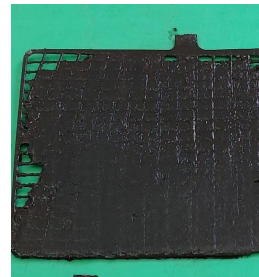
- The study showed that it is possible to reduce PAM by 5% in combination with the Dynagrid® NG New scrim, used for mechanical protection.
- DYNAGRID® NG NEW grades either kept the plate in better condition or extended cycle lifetime.
- Combination of optimized and reduced PAM with Dynagrid® NG NEW provides better batteries with lower costs.



Standard SLI paste with standard pasting paper



Optimized SLI paste, 5% reduction with Dynagrid® NG NEW



Visit us at booth #46 to
receive more information. We
look forward to welcoming
you.



G L A T F E L T E R