



LIGHTEN YOUR BATTERY!



TbLS+®



TBLS+[®] FOR ALL TYPES OF AUTOMOTIVE AND INDUSTRIAL BATTERIES

PENOX GmbH developed tetra-basic lead sulphate seeding material (with a particle size of 0.5 micron) enabling the battery manufacturer to produce tetra-basic cured positive active materials with control of the porosity and the crystal size of positive active material. Due to the fact that TBLS+[®] is delivered as a slurry it is possible to distribute the seeds very homogeneously within the paste by adding 0.5% up to 2% of the product.

Industrial battery manufacturers are using TBLS+[®] successfully to increase the initial capacity of the battery without losing any performance in deep cycle tests.

For Advanced Batteries EFB/AGM, TBLS+[®] can replace expensive advanced carbons in the negative plate to improve high current and dynamic charge acceptance.

ADVANTAGES

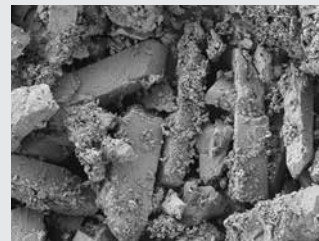
- › Formation of a porous PAM structure during charging operations to support acid exchange and battery operation
- › Formation of smaller lead sulphate crystal structures during discharge operations
- › Increase in service life due to stable crystalline structures during discharge/charge operations
- › TBLS+[®] reduces water consumption
- › TBLS+[®] is supplied as a slurry which supports the homogenous distribution of the seeds in the paste

SIGNIFICANT PERFORMANCE IMPROVEMENT OF LAB

Tetrabasic (4-basic) lead sulphate

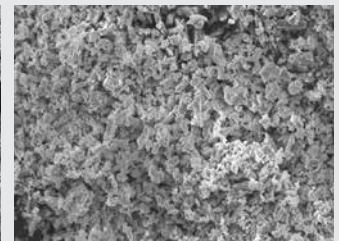
- › Gives more stable capacity C20 in discharge and recharge applications
- › Limits passivation after deep discharge (Sb free effect)
- › Improves cycling performance under partial state of charge
- › Avoids softening of the active material in lifetime tests (hot cycling tests at 60 °C and more)
 - › **Longer lifetime batteries**
 - › **Less variation for battery performance during lifetime**

WHY TETRA BASIC WITH TBLS+[®]?



without TBLS+[®]

→ 10 µm



with 1% TBLS+[®]

→ 10 µm

SAVE MONEY – INCREASE PERFORMANCE

AUTOMOTIVE AND INDUSTRIAL:

- › Curing/drying – time savings
- › Formation – time and energy savings
- › Increase of cycle life performance

AUTOMOTIVE:

- › TBLS+® improves porosity in the PAM, direct AM savings of up to 6.5%
- › With 1% TBLS+® porosity improves in the PAM, direct AM savings of up to 6.5%
- › With 1% TBLS+® and battery redesign, total savings of up to 10%
- › TBLS+® balances the battery »electrical system«, improves NAM performance

COMPOSITION

TBLS+® is a tetra basic lead sulphate produced by the reaction of lead oxide with sulphuric acid, chemical formula $PbSO_4$, 4 PbO .

TBLS+® has a very small particle size and is specially treated for applications in the battery industry (lead accumulator). The product is supplied as a slurry, suspended in water.

The minimum content of tetrabasic seed crystals in the slurry is 32%. A special additive avoids the formation of agglomerates in the slurry and increases the shelf life of the material.

HOW MUCH TBLS+®? ¹⁾

- › **SLI batteries for standard/flooded applications:**
0.8 to 1 % TBLS+® results in a 4 basic $PbSO_4$ crystal 10 -12 μm
- › **AGM / Gel / EFB batteries:**
1 to 1.5 % TBLS+® results in a 4 basic $PbSO_4$ crystal <10 μm
- › **Batteries for deep cycling applications:**
0.3 to 0.8% TBLS+® results in 4 basic $PbSO_4$ crystals <20 μm

¹⁾ The final crystal size is also dependent upon the acid:oxide ratio in the paste mix

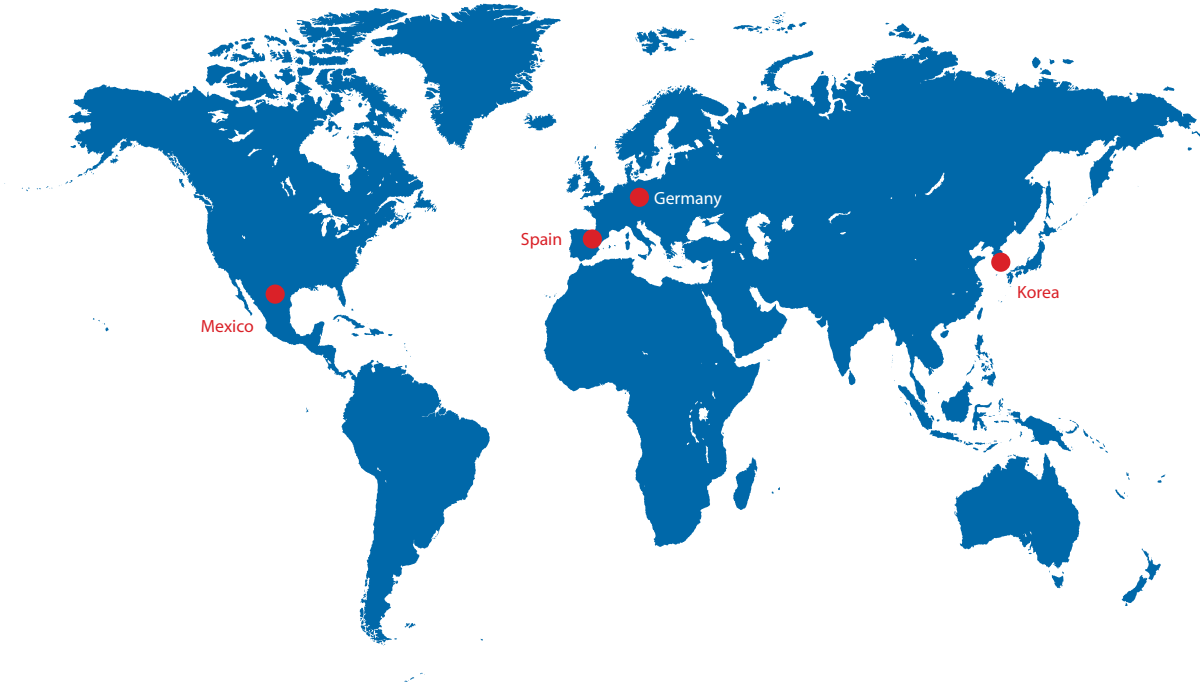
TECHNICAL DATA

Solids	content	%	39 - 45	DIN ISO 787-2
Particle Size	d99	μm	< 3.6	PV109, Laser Diffraction
	d50	μm	< 0.6	PV109, Laser Diffraction
Density of the slurry ²⁾	type	g/cm ³	1.45 - 1.75	DIN EN ISO 787-10
Content of seeds	content	%	> 32	PV261, FTIR Spectroscopy
Pb (total) of the lead compound	content	%	83 - 85	PV265, EDTA Titration
Iron	max.	%	0.002	PV 450, ICP

TBLS+® is free of carbon compounds and other components that can affect the battery.

²⁾ depends on the content of tetra basic seed crystals of the raw material

PENOX EXPERTISE ALL AROUND THE WORLD



For more information on our products and services for the battery producer, please visit our updated website:

www.penoxgroup.com

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