Silox

A new generation of activators

A path to a low carbon footprint

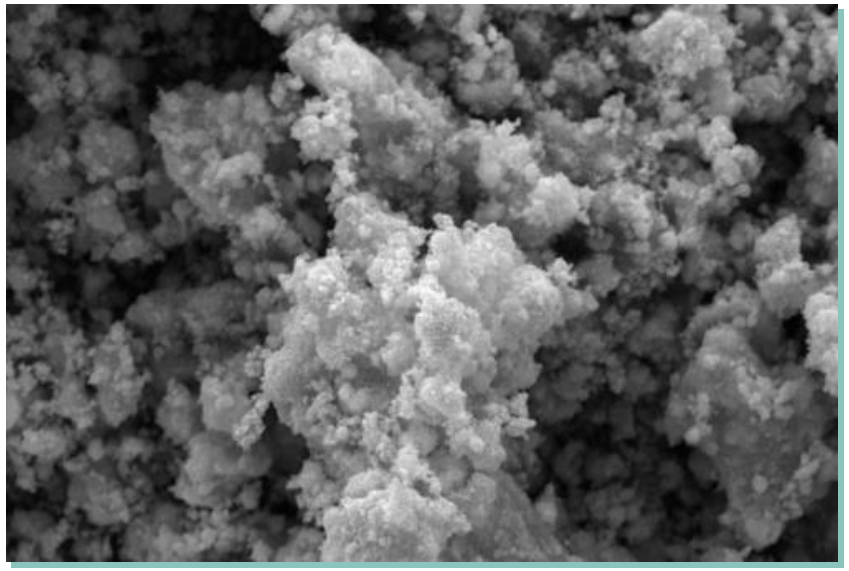
Acti ECO+

Acti ECO+ GREEN

Silox Belgium process

The method of production involves precipitation of zinc-based solutions into zinc oxide.

The precipitate is dried or calcined to remove water and/or carbon dioxide resulting in a large variety of zinc oxide morphology.



The efficiency of zinc oxide during vulcanization is improved by maximising contact between zinc oxide particles and the components of formulation.
Higher efficiency is obtained with high surface area small particles uniformly dispersed throughout the rubber matrix

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Life Cycle Analysis

A Life Cycle Assessment (LCA) is defined as the systematic analysis of the potential environmental impacts of products or services during their entire life cycle.

This also includes the upstream (e.g., suppliers) and downstream (e.g., waste management) processes associated with the production (e.g., production of raw, auxiliary and operating materials), use phase, and disposal (e.g., waste incineration).

Life cycle impact assessment (LCIA) covers all relevant inputs from the environment (e.g., ores and crude oil, water, land use) as well as emissions into air, water and soil (e.g., carbon dioxide and nitrogen oxides).

Grade	Circularity/ Natural	Fossil-based derivatives	Bio-based derivatives
Gold Seal	10-15%	0%	0%
Silox Actif ActiECO+ ActiECO+ Green	15 % 60 % 94 %	0% 0-20% 0%	0% 0% 0-15%

LCA parameters

- ISO 14040 & 14044 based
- Developed by Sphera Solutions Inc.
- Using GaBi software system
- 16 impact categories

EF 3.1
EF 3.1 Acidification
EF 3.1 Climate Change - total
EF 3.1 Ecotoxicity, freshwater - total
EF 3.1 Eutrophication, freshwater
EF 3.1 Eutrophication, marine
EF 3.1 Eutrophication, terrestrial
EF 3.1 Human toxicity, cancer - total
EF 3.1 Human toxicity, non-cancer - total
EF 3.1 Ionising radiation, human health
EF 3.1 Land Use
EF 3.1 Ozone depletion
EF 3.1 Particulate matter
EF 3.1 Photochemical ozone formation, human health
EF 3.1 Resource use, fossils
EF 3.1 Resource use, mineral and metals
EF 3.1 Water use

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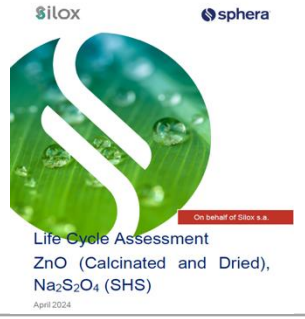
Carbon footprint

CFP parameters
- ISO 14067 based
- Sphera LCA related
- “Cradle to gate”
  - Scope 1 & 2
  - Scope 3 upstream
- Elemental allocation (co-products)



Product	CO_2 eq/kg product	Remark
Gold seal	3,90	Sphera
Silox 2C - Actif	3,58 – 3,46	Sphera
ActiECO+	1,57	Sphera Industry (ingredients)
ActiECO+ Green	1,36	Sphera Industry (ingredients)

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Grade range

	Standard	Active			Acti^{ECO+}		Acti^{ECO+} Green	
Grade	2C	Actif HR30	Actif Free-Flowing®	ZINECO	Acti^{ECO+}	Acti^{ECO+} C	Acti^{ECO+}*Green*	Acti^{ECO+}*Green C*
Form	Powder	Powder	Micro balls	Powder	Powder	Powder	Powder	Powder
SSA (m^2/g)	5-8	30-50	40-50	40-50	N/A	N/A	N/A	N/A
phr	5	3	3	3	**5**	**3**	**5**	**3**
Purity	+++	+++	+++	+++	+++	+++	+++	+++
Blending/dispersion	=	Improved	Improved	Improved	Best	Best	Best	Best
Ecotoxicity	Yes	Yes	Yes	No	No	No	No	No
Formulation CFP	=	Low	Low	Low	Very low	Very low	Very low	Very low
Circularity/natural	+	+	+	+	++	++	+++	++
Stability	+	+	+	+	+++	+++	++	++
Formulation cost	=	Low	Low	Low	Low	Low	Low	Low
Packaging	25 kg bag 1000 kg FIBC	20 kg bag 500 kg FIBC	25 kg bag 1000 kg FIBC	20 kg bag 500 kg FIBC	25 kg bag 500 kg FIBC	25 kg bag 500 kg FIBC	25 kg bag 500 kg FIBC	25 kg bag 500 kg FIBC

Traditional *ZnO*	Active *ZnO*	Not *Toxic*

Avoid reformulation
Perform like any zinc oxide
Cost control
Easy transportation

Not toxic
Easy storage
We only have one planet!

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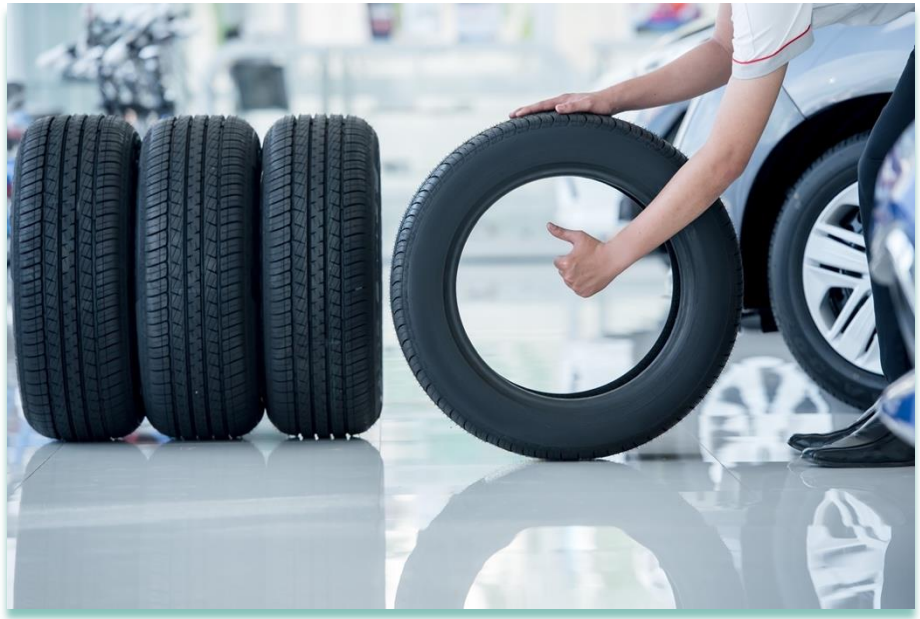
Rubber compound



Component	phr
TSR 10	80
BR 1220L	20
N347	55
S. naph. oil	7
6PPD	2
TMQ	1
CBS	0.8
Sulfur	2.3
Stearic acid	2.5
ZnO	5

	ZnO 5 phr	Acti^{ECO+} 5 phr
Tmin	2.38 ±0.01	2.44 ±0.02
Tmax	17.04 ±0.06	16.12 ±0.02
Delta	14.67 ±0.05	13.68 ±0.02
Ts2	1.05 ±0.01	1.01 ±0.01
T50	1.52 ±0.01	1.45 ±0.01
T90	2.68 ±0.04	2.50 ±0.03
INITIAL		
TS (MPa)	19.3 ± 1.5	19,9 ± 1.3
El (%)	355 ± 21	357 ± 7
Mod 100	2.3 ± 0.2	2.6 ± 0.2
Mod 200	7.8 ± 0.4	8.0 ± 0.6
Mod 300	14.8 ± 0.6	15.4 ± 0.8
Hard (Sh-A)	61 ± 1	61.5 ± 1
7 Days; 70°C		
TS (MPa)	19	21
El (%)	340	*340*
Mod 100	2,9	*3,5*
Mod 200	8,9	*10,1*
Mod 300	16	*17*
Hard (Sh-A)	62,5	*62,5*

Rheology and mechanical properties at least equivalent to Gold Seal

ActiECO+ can easily replace any conventional zinc oxide

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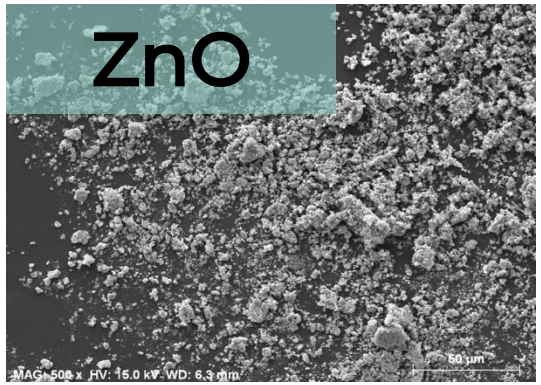
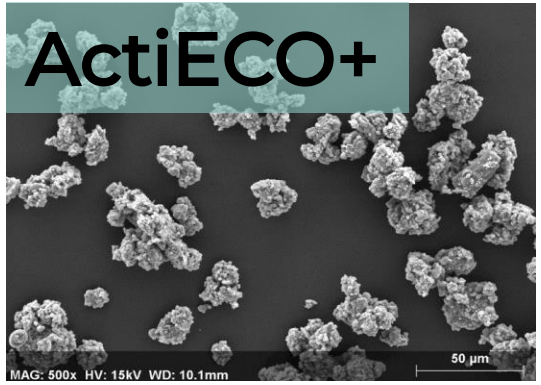
Improved mixing



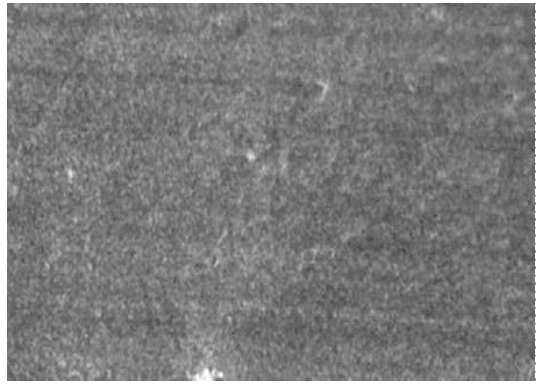


Traditional zinc oxide contains fine particles:

- dustiness
- health hazard
- difficult dispersion

ActiECO+ contains no fines :

- no dust
- healthier for operators
- better dispersion



A shape and morphology optimised for rubber compounding

(improving the micro-structure of the compound)

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Purity

Acti ECO+

Acti ECO+ GREEN

Element	Results	Units
Pb	< 20	ppm
Cd	< 2	ppm
Cu	< 5	ppm
Mn	< 10	ppm

Levels equivalent to Gold seal/Pharma grades

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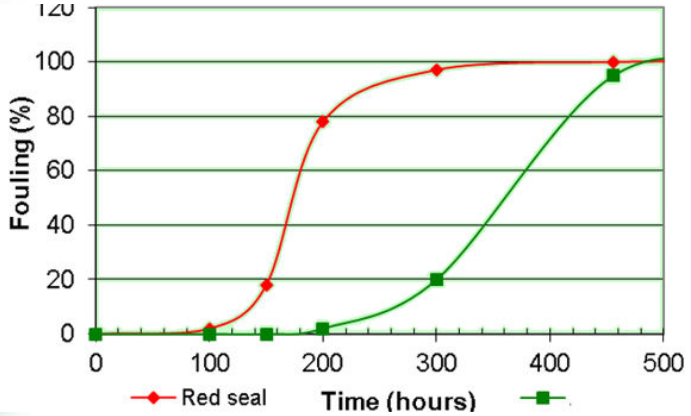
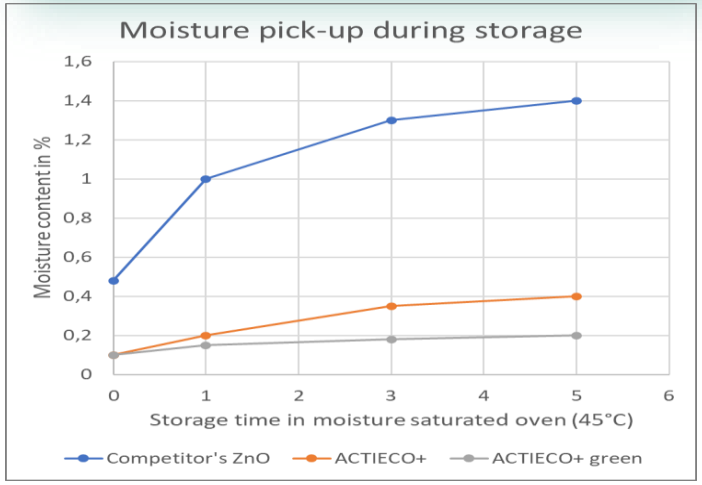
Additionnal benefits





Zinc stearate, present in large quantities, is one possible substance causing blooming

ZnS deposition adheres to the mold followed by a gray build-up of layer deposit

ZnS formation:

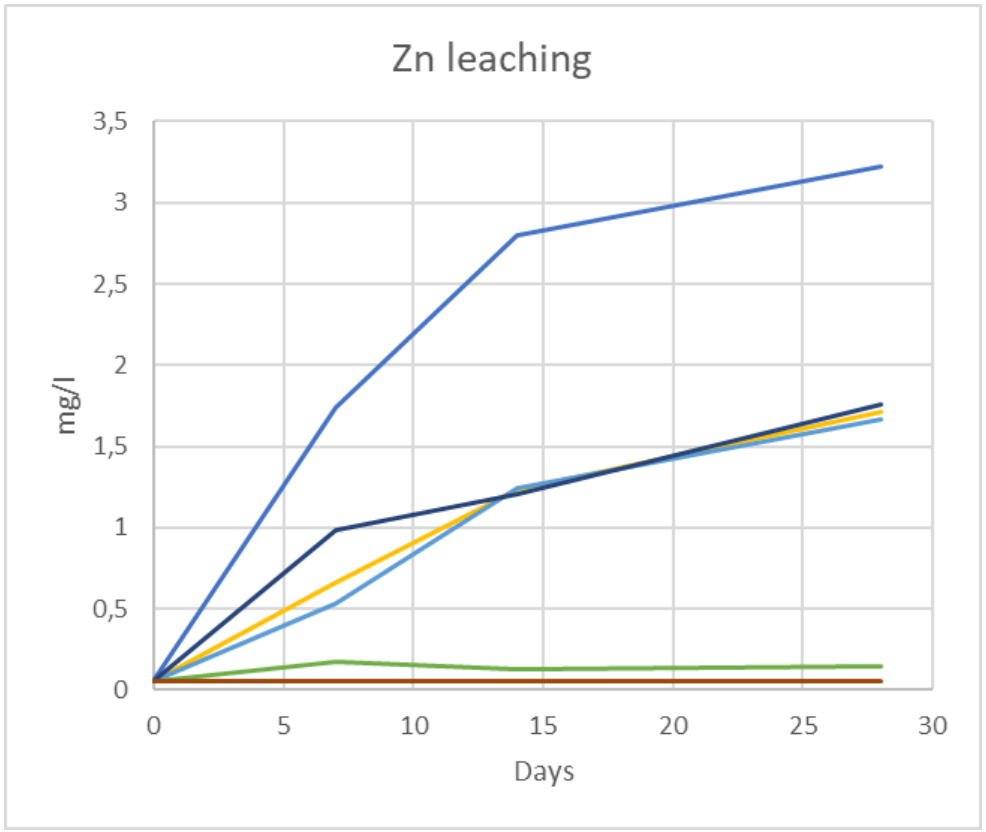
- ZnO or zinc stearate and hydrogen sulfide (H_2S)
- Zinc salt of MBT with sulfur and H_2S
- ZnO and polysulfidic crosslinks of the vulcanisate

Better performance in long-term storage
Material non-sensitive to moisture

Improved ZnO distribution giving a better microstructure

Compatible with foamed applications

Other benefits



White/gold seal 5phr

ActiECO+ 5phr

Reduced leaching resulting from the use of the ActiECO+
Suppressed leaching due to biobased ingredients that act as a barrier

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Hydrometal France

Incorporated in 2021, it belongs to our Recycling & Refining segment (JGI-Hydrometal).
Located in Dunkirk, this site is dedicated to the hydrometallurgical treatment of complex non-ferrous materials.
It represents a circular alternative to landfilling and contributes to the development of sustainable solutions against the depletion of natural resources.

Product	CO_2 eq/kg product	Remark
ActiECO+ Green	1,36	Sphera Industry (ingredients)
ZincOPALE	*1,18*	*ULiège*
ActiECO+ Green ZincOPALE	*0,45*	*ULiège Industry (ingredients)*
Gold seal	3,90	Sphera

Circular and low carbon footprint of new zinc source (ZincOPALE) will be a further step for the development of ActiECO+ Green activators

We bring a major reduction of carbon footprint compared to Gold seal

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Intellectual property

ActiECO+ IP protection in progress : 4 patents

- Detoxification (filled December 2017)
- Preliminary product (granted January 2024)
- ActiECO+ (filled April 2022)
- ActiECO+ green (filled December 2022)

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Silox

Acti ECO+
Acti ECO+ GREEN

A new engineered generation of sustainable activators...

- Flexible technology for tailor-made products
- Complementary products to our Silox grade range
- Specialty materials which fit in your formulation, **designed to replace any grade of zinc oxide**

Better sustainability
Non-ecotoxic
Lower carbon footprint

Enhanced properties
Best dispersion
Faster curing
Reduced leaching

Better attributes
Less fouling
Less blooming
Stability in storage

Better economics
Cost effective
Less price volatility

Let's talk and see what we can do together!

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Thank you!

Olivier Roumache
Quality & Technical Dev. Manager
oroumache@silox.com

Manuela Avanzi
Sales Manager
manuela.avanzi@praychim.it

Grégoire Nelis
Key Account Manager
gnelis@silox.com

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