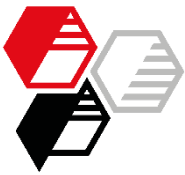




Exploiting the full potential of Silfit Z 91 in gray washing machine gaskets

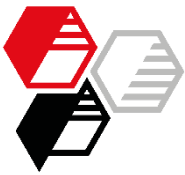
Author: Nicole Holzmayr



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Status Quo

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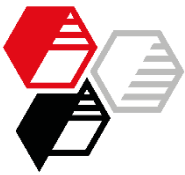
RESULTS

SUMMARY

The study "Silfit Z 91 in gray-colored Washing Machine Gaskets" demonstrates clearly that the replacement of calcined clay and silica by **Silfit Z 91** results in equal or even better rheological and mechanical properties.

Since silica is no longer contained in this formulation, the necessity of DEG, processing aids and ZnO have to be questioned.

The results also suggest an examination of **Silfit Z 91's** further performance potential.



Objective

Demonstrating the potential of **Silifit Z 91** in comparison to the commonly used combination of silica and calcined clay targeting at least comparable

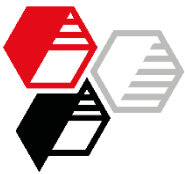
- rheological and physical properties
- color
- additional benefits

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Preparation and Curing of the Compound

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- **Mixing**

Open mill Ø 150 x 300 mm

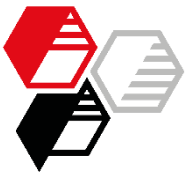
Batch volume: approx. 700 cm³

Temperature: 50 °C

Mixing time: approx. 15 min.

- **Curing**

Press, 180 °C, 10 min.



Formulation

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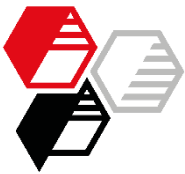
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	Control	a	b	c
Vistalon 3666	175	175	175	175
Stearic Acid	1	1	1	1
Zinkoxyd aktiv	5	2	2	2
Processing aid	3			
DEG	3			
TESPT (Si-69 or equivalent)	0.8	0.8	0.8	1.0
Kronos 2222	9	9	9	9
Corax N 550/30	0.2	0.2	0.2	0.2
Sunpar 2280	60	60	60	60
Rhenogran MBT-80	2.4	2.4	2.4	2.4
Sulfur	0.7	0.7	0,7	0.7
Rhenogran CLD-80	1.2	1.2	1.2	1.2
Rhenocure TP/S	3.6	3.6	3.6	3.6
Ultrasil VN 3	23			
Polestar 200 R	120			
Silfit Z 91		166	185	200



Mooney Viscosity

DIN 53 523 Part 3, ML 1+4, 120 °C

■ no DEG / proc. aid
2 phr ZnO

MU

0 10 20 30 40

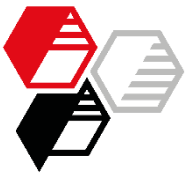
Control

166 phr Silfit Z 91
0.8 phr TESPT

185 phr Silfit Z 91
0.8 phr TESPT

200 phr Silfit Z 91
1.0 phr TESPT

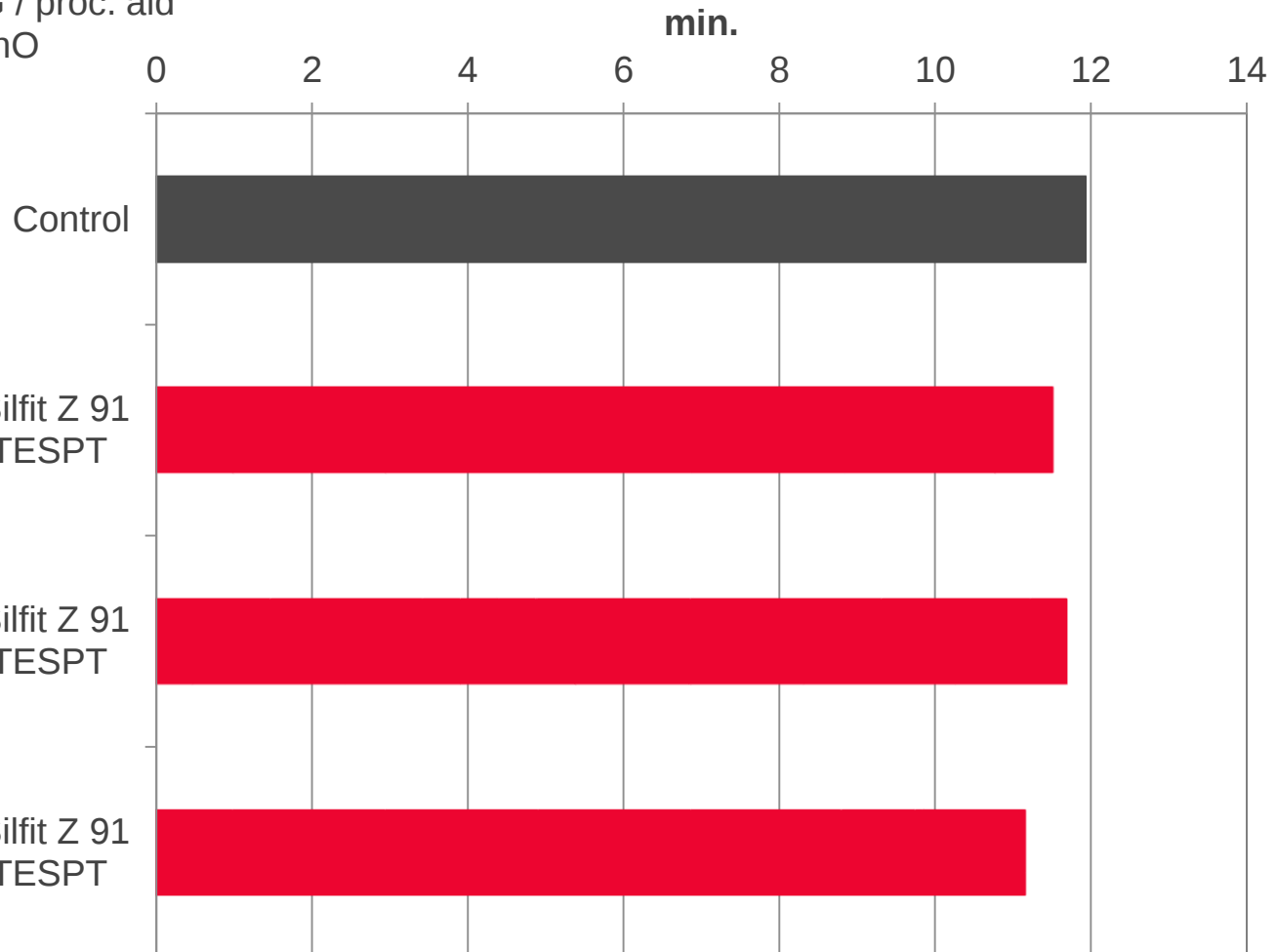




Mooney Scorch Time

DIN 53 523 Part 4, ML +5, 120 °C

■ no DEG / proc. aid
2 phr ZnO



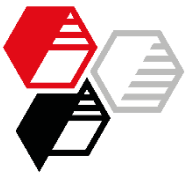
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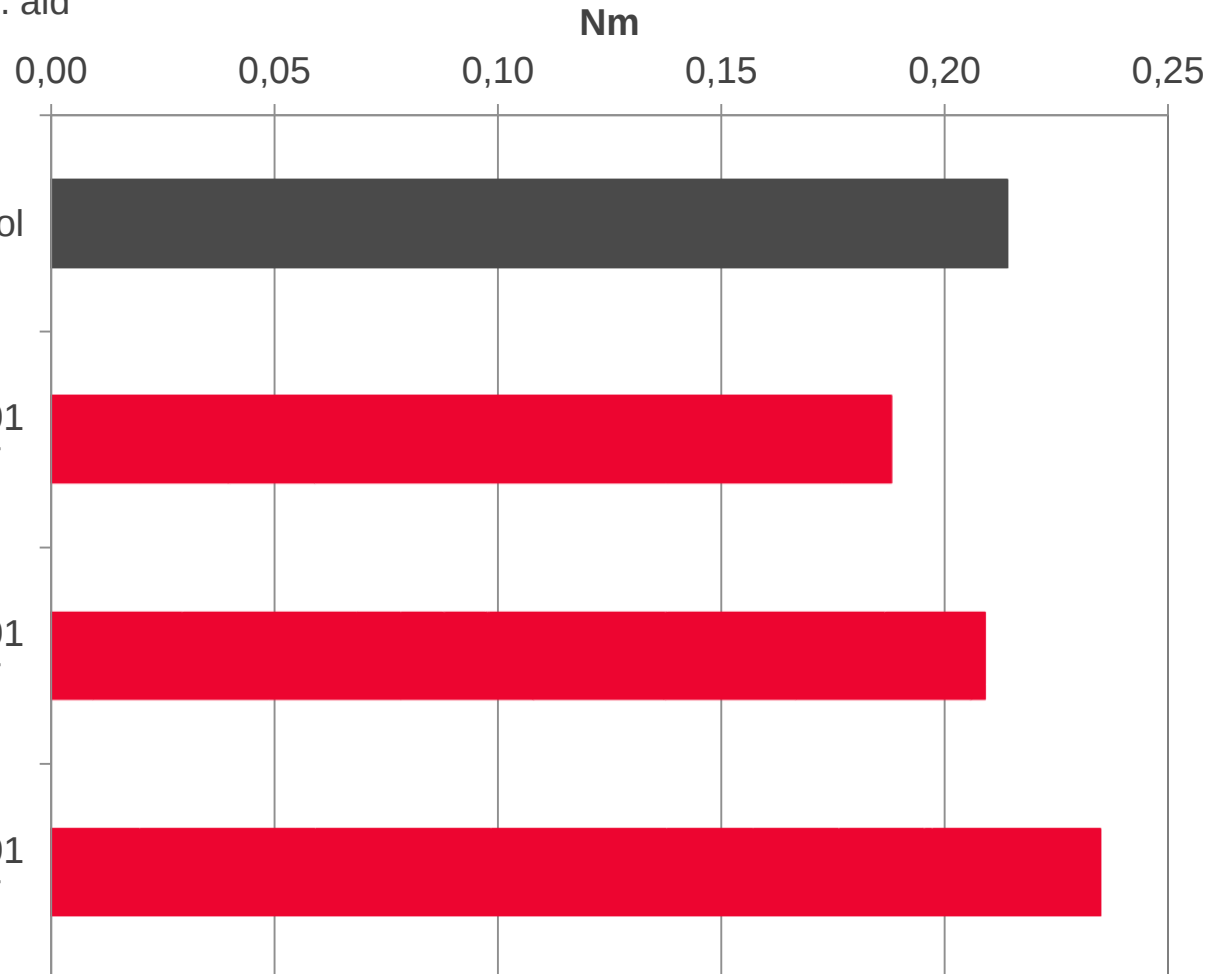


Torque Max. – Min.

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DIN 53 529-A3, 180 °C, 0.2° deflection – Göttfert Elastograph

■ no DEG / proc. aid
2 phr ZnO



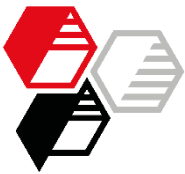
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Conversion Time t_{90}

DIN 53 529-A3, 180 °C, 0.2° deflection – Göttfert Elastograph

■ no DEG / proc. aid
2 phr ZnO



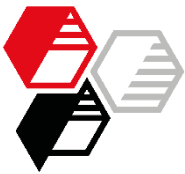
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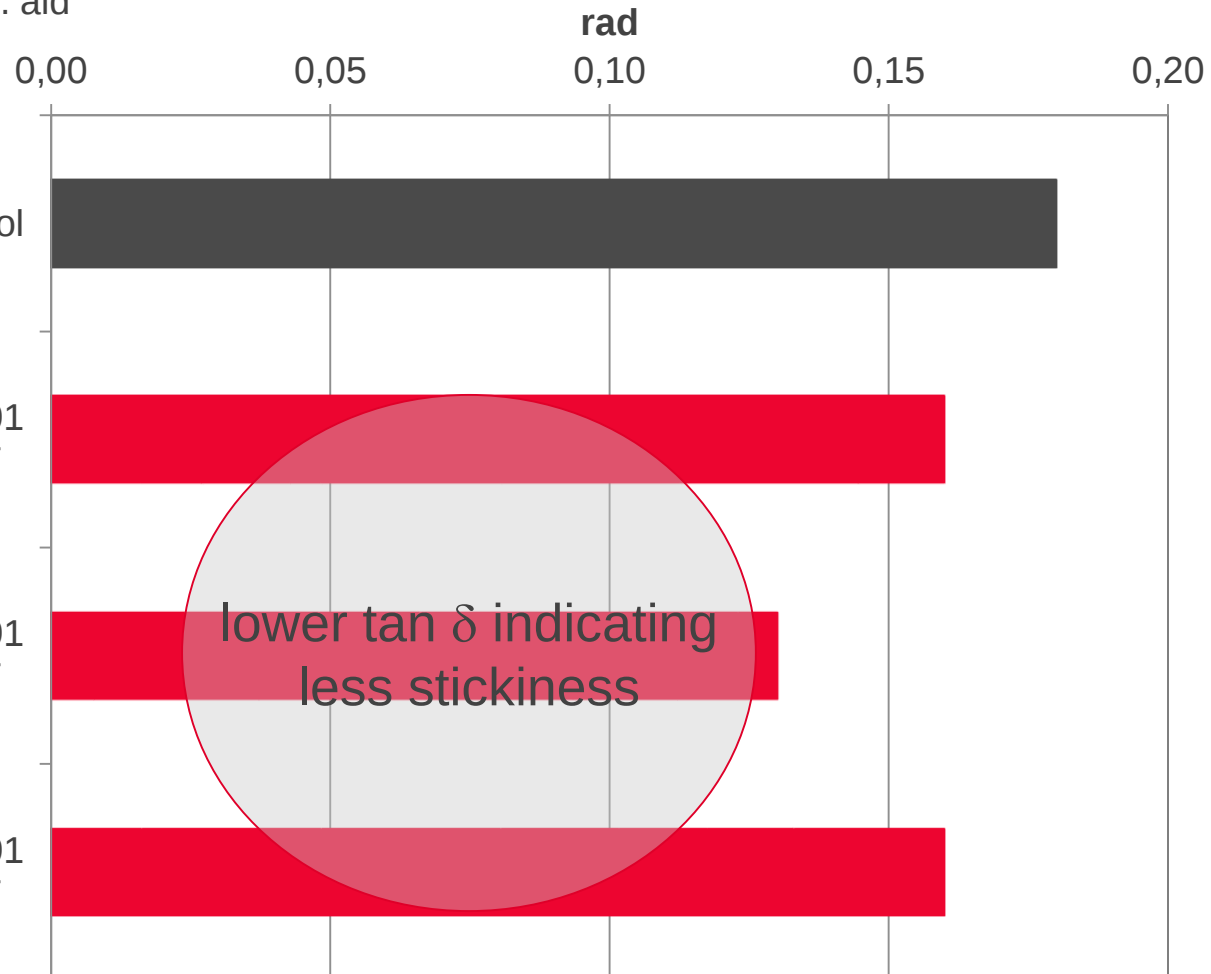
SUMMARY



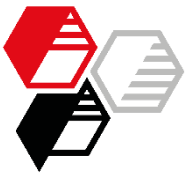
$\tan \delta$ after 16 min.

DIN 53 529-A3, 180 °C, 0,2° deflection – Göttfert Elastograph

■ no DEG / proc. aid
2 phr ZnO



lower $\tan \delta$ indicating
less stickiness



Hardness

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DIN 53 505-A, piled-up S2 dumbbells

■ no DEG / proc. aid
2 phr ZnO

Shore A

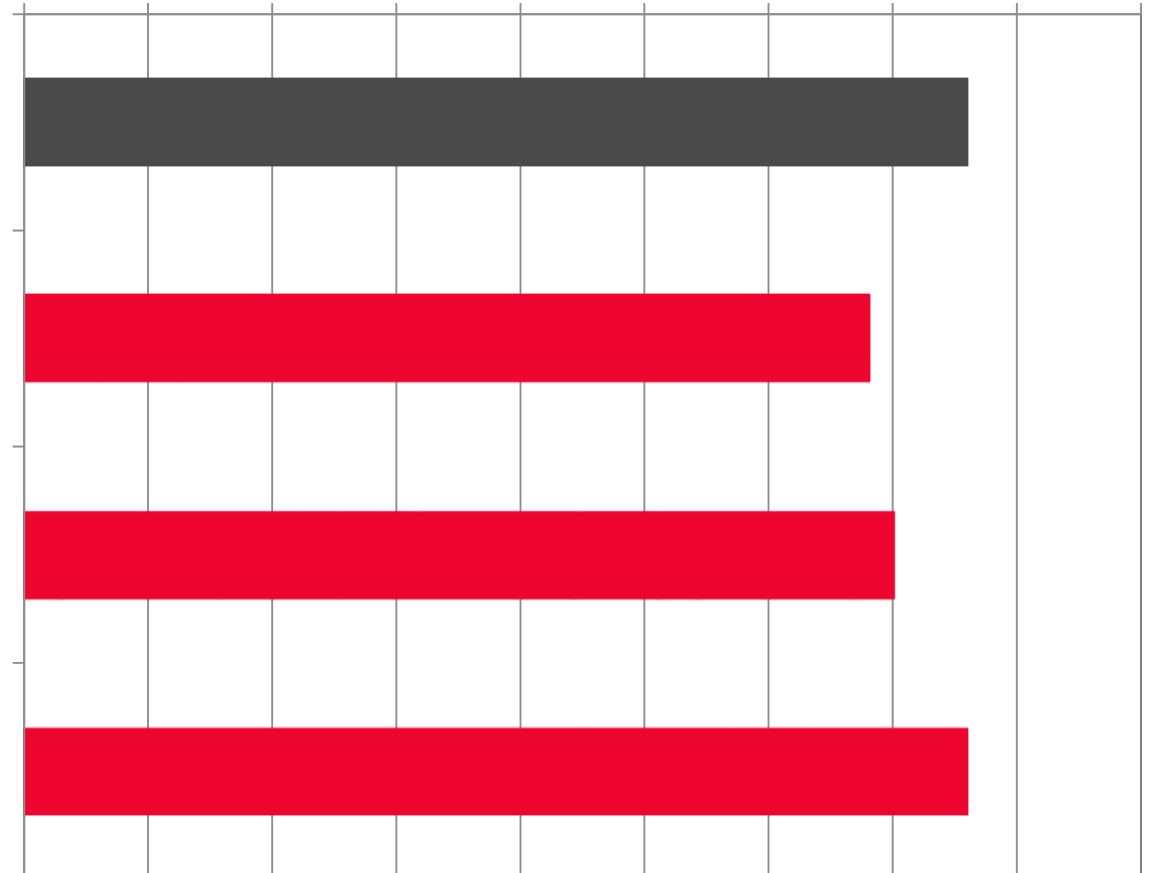
0 5 10 15 20 25 30 35 40 45

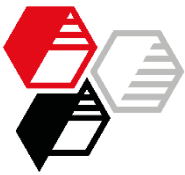
Control

166 phr Silfit Z 91
0.8 phr TESPT

185 phr Silfit Z 91
0.8 phr TESPT

200 phr Silfit Z 91
1.0 phr TESPT



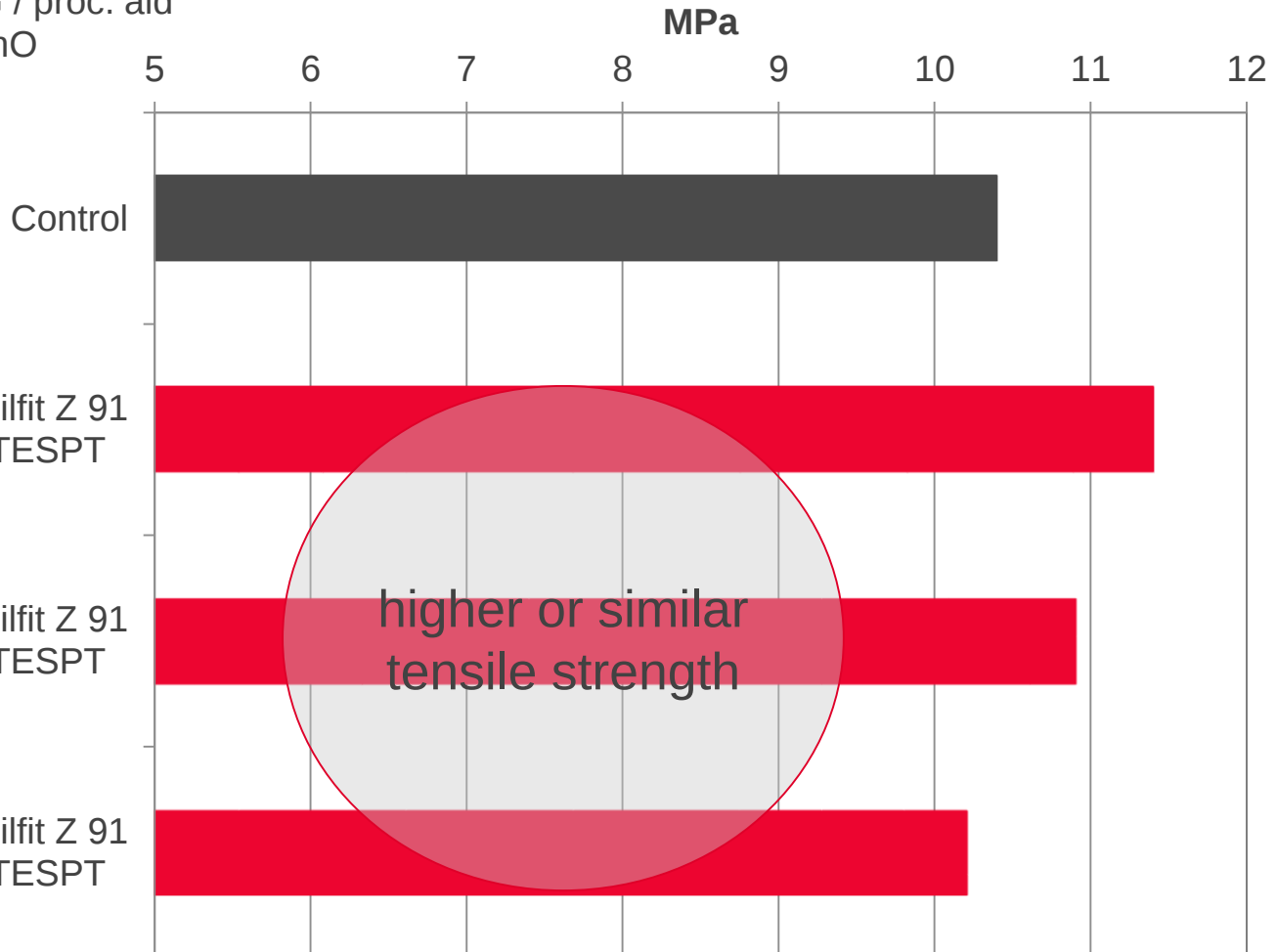


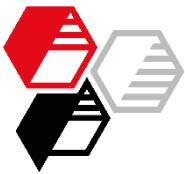
Tensile Strength

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DIN 53 504, S2

■ no DEG / proc. aid
2 phr ZnO



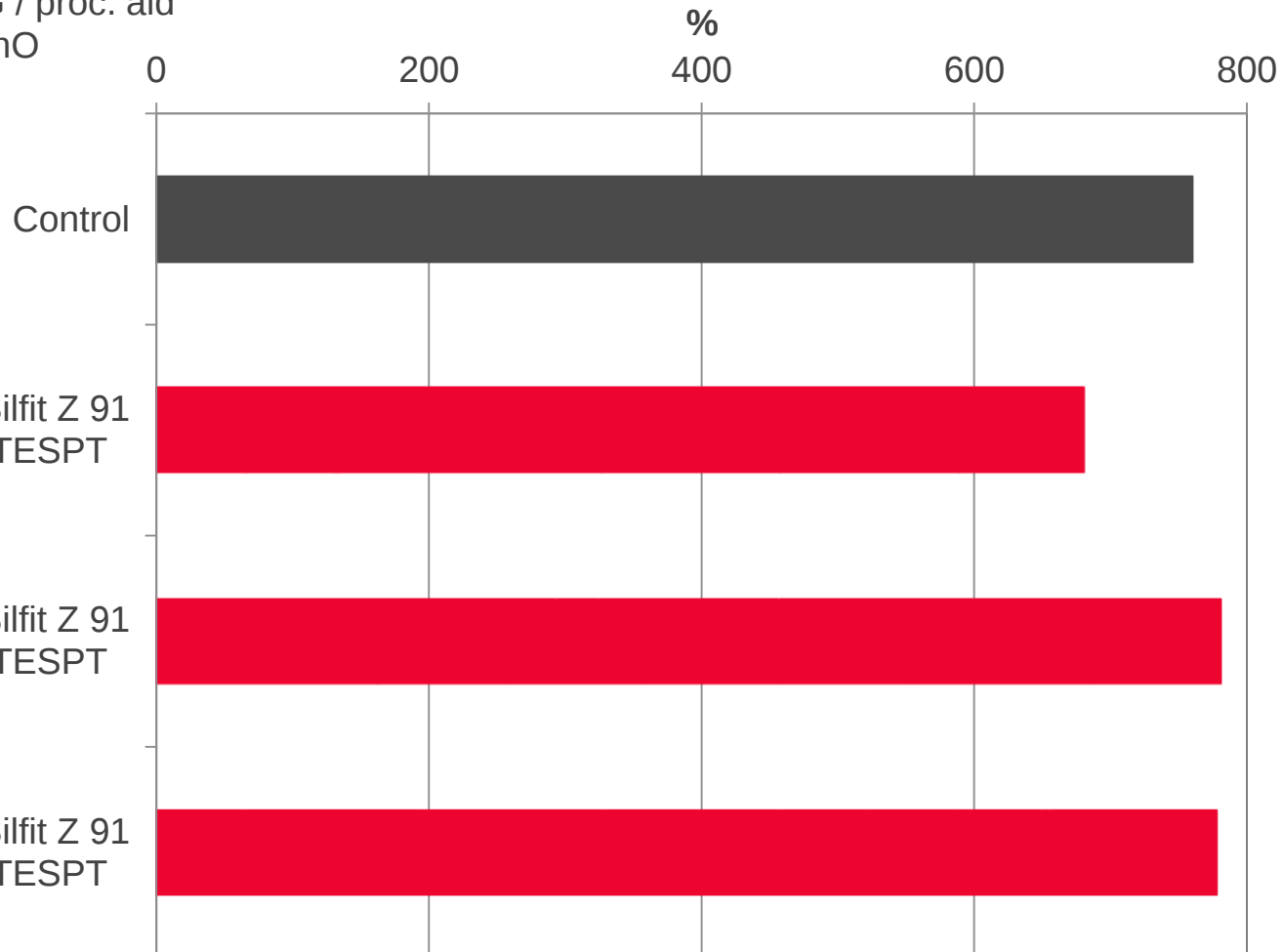


Elongation at Break

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DIN 53 504, S2

■ no DEG / proc. aid
2 phr ZnO



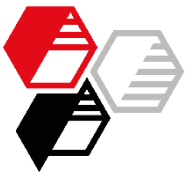
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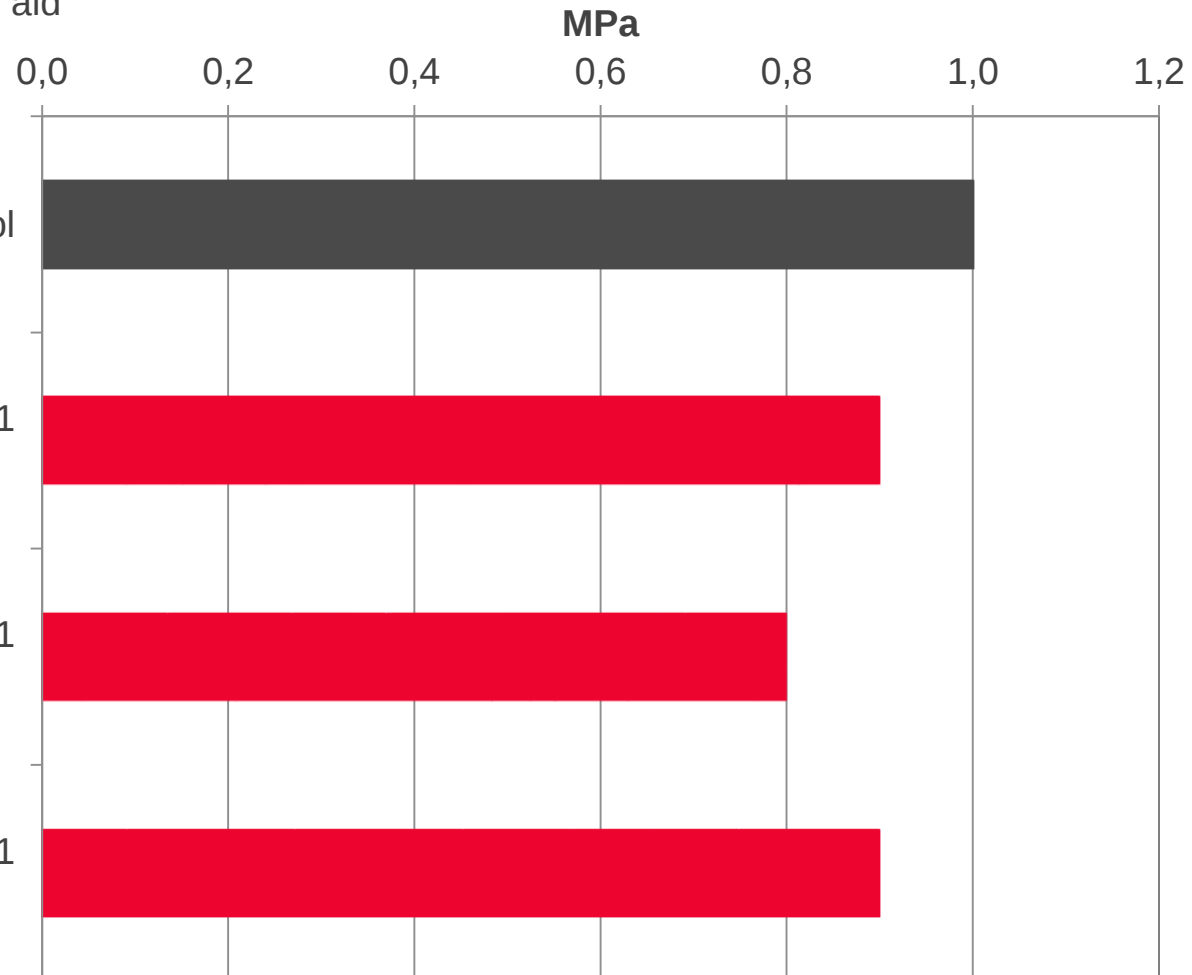
SUMMARY

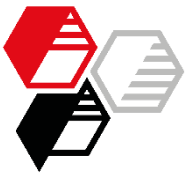


Modulus 100 %

DIN 53 504, S2

■ no DEG / proc. aid
2 phr ZnO

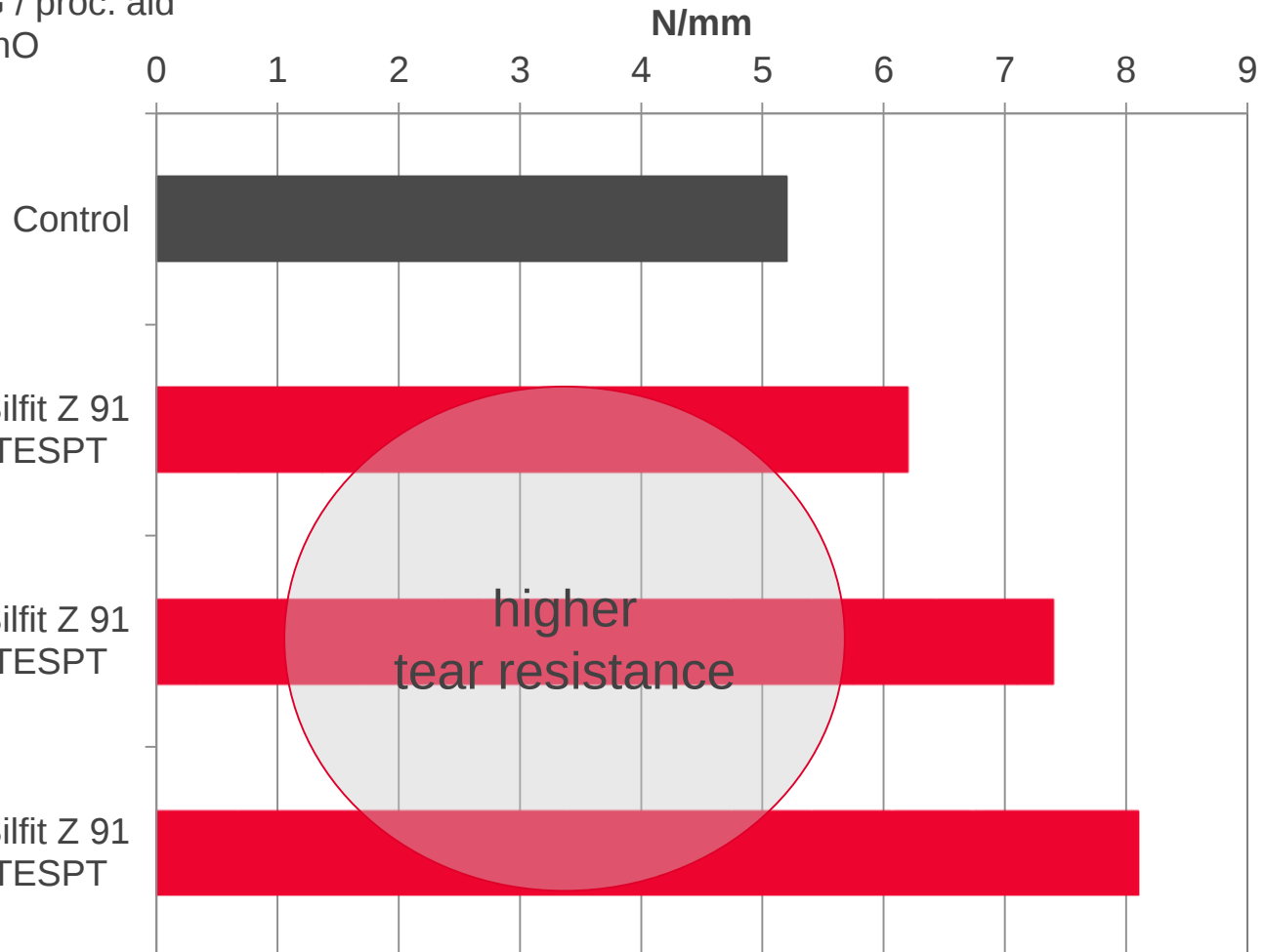


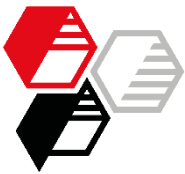


Tear Resistance

DIN ISO 34-1, trouser specimen

■ no DEG / proc. aid
■ 2 phr ZnO



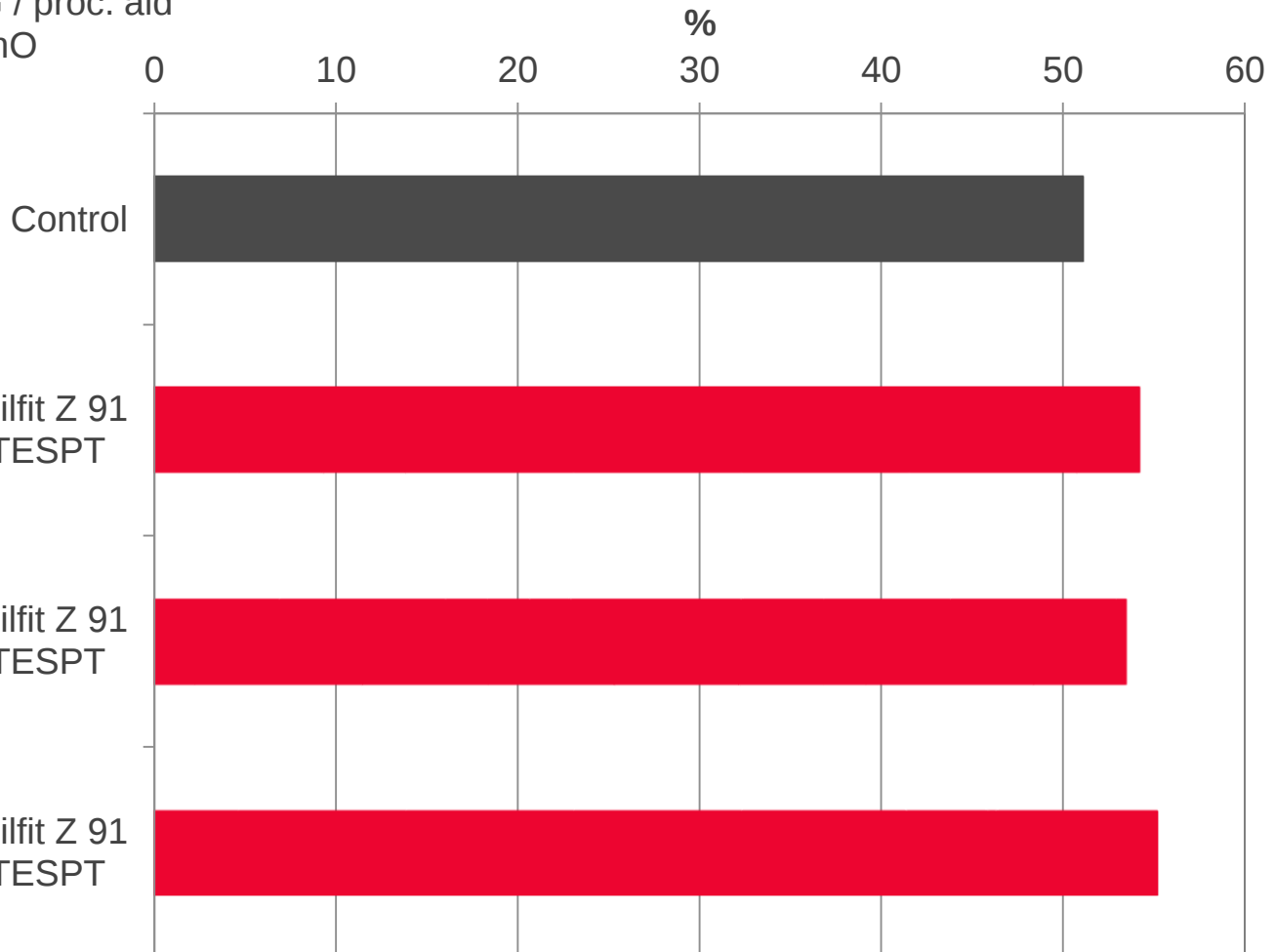


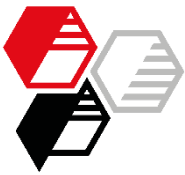
Compression Set

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DIN ISO 815-1 B, 25 % defl., cooling method A, 72 h / 100°C

■ no DEG / proc. aid
2 phr ZnO





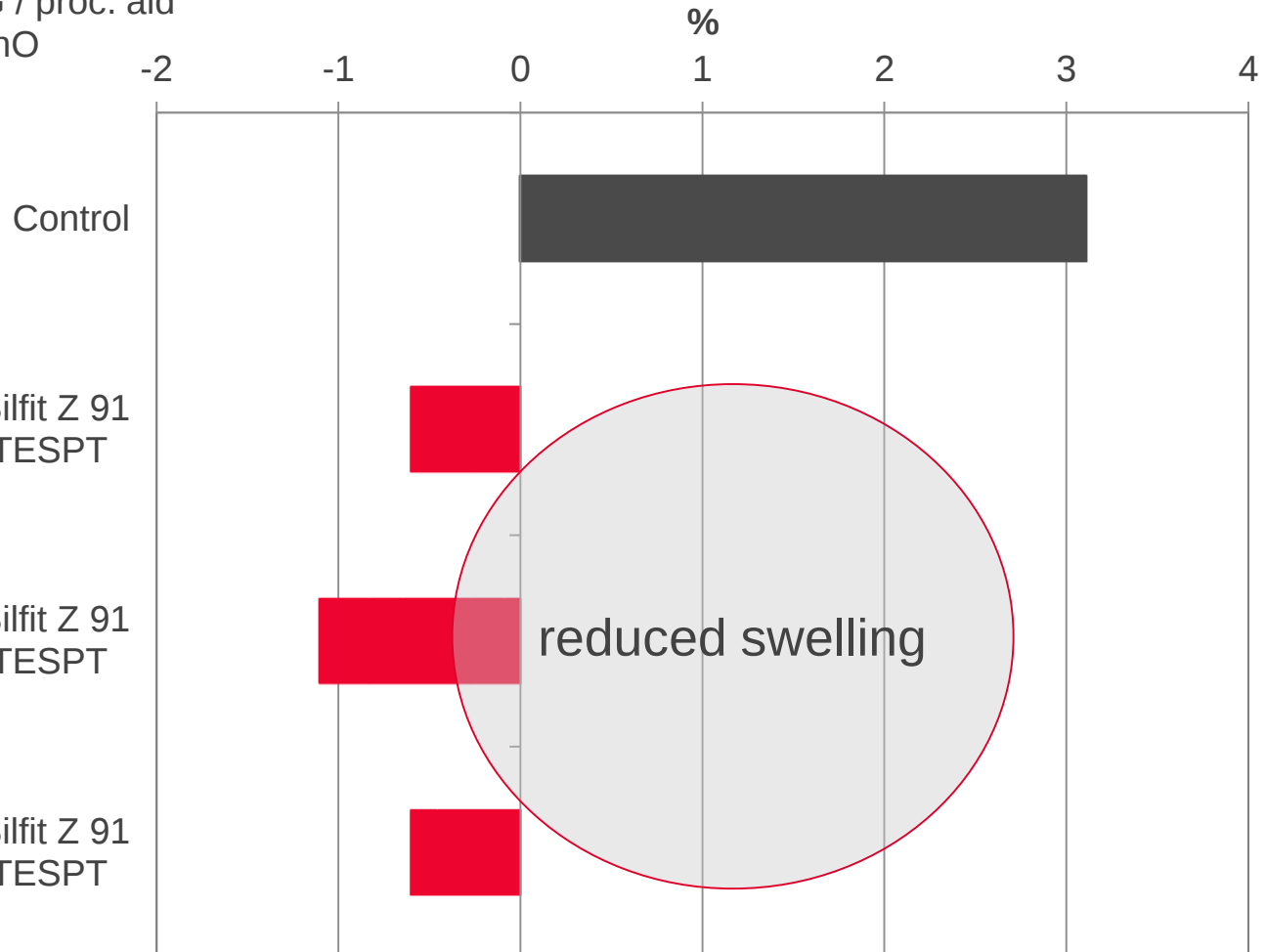
Immersion in Detergent

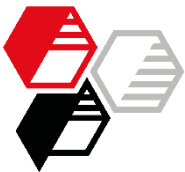
Change of Volume

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2 % Persil in tap water, 100 h / 100 °C

■ no DEG / proc. aid
2 phr ZnO



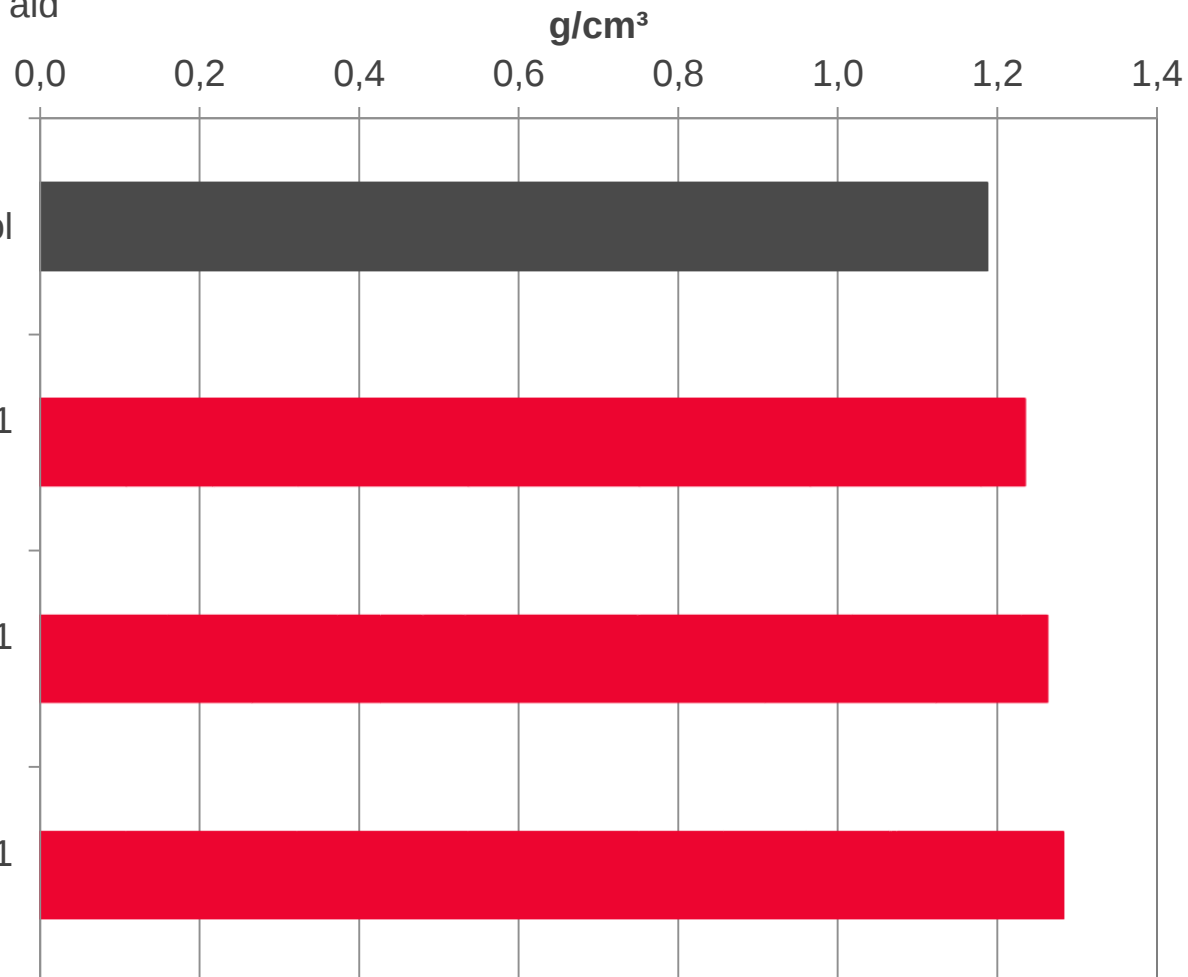


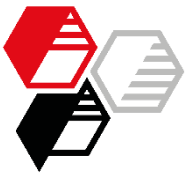
Density

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DIN EN ISO 1183-1

■ no DEG / proc. aid
2 phr ZnO



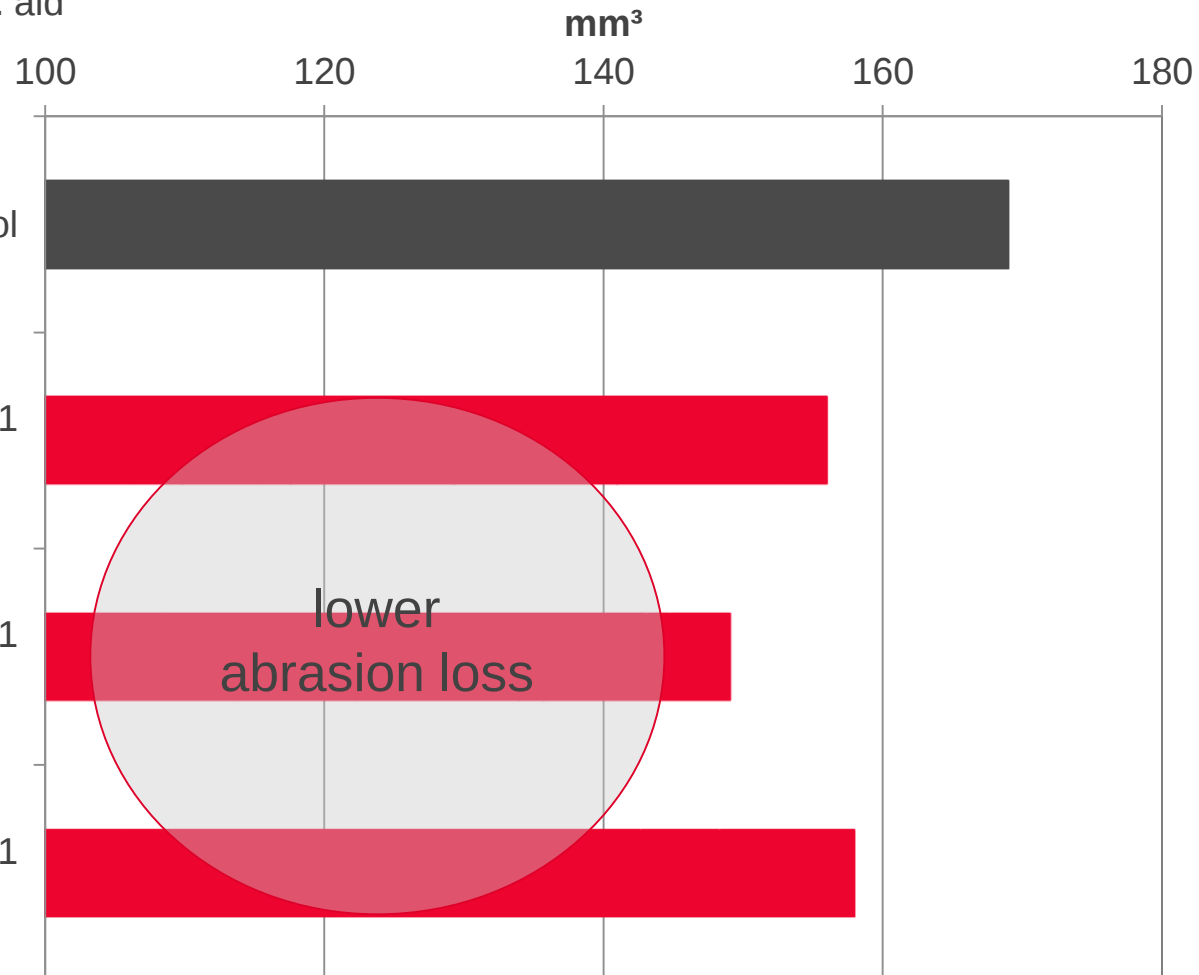


Abrasion Loss 5 N

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DIN ISO 4649

■ no DEG / proc. aid
2 phr ZnO



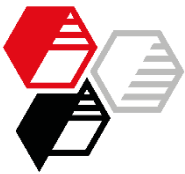
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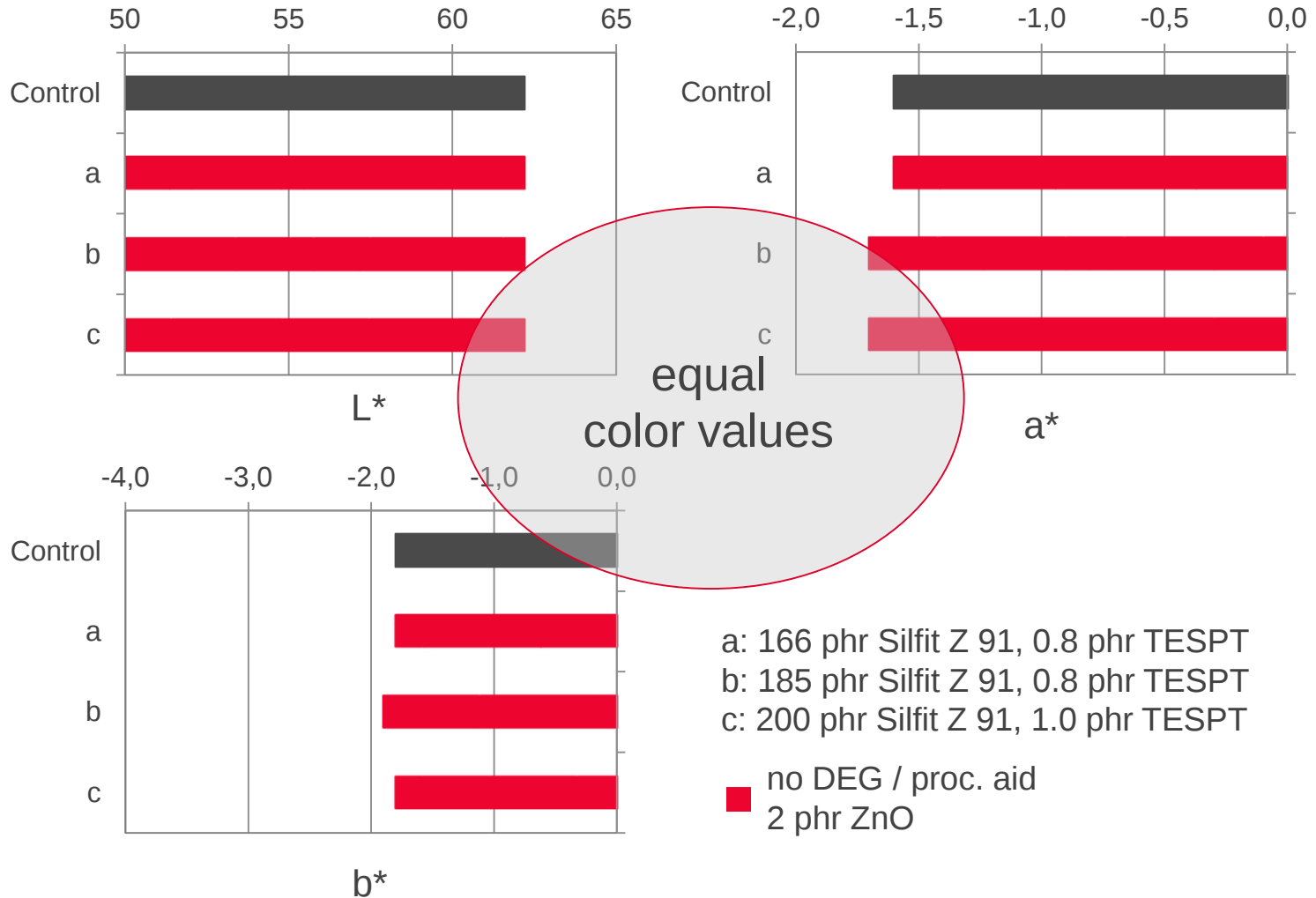
SUMMARY

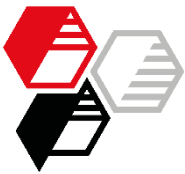


Color Values

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ISO 7724





Conclusion

Optimizing a formulation for washing machine gaskets by exploiting the full potential of **Silfit Z 91** results in:

equal rheological and mechanical properties plus the following benefits:

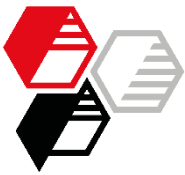
improved mechanical properties

+

cost reduction potential

- $\tan \delta$ (along with tear resistance)
→ uncritical demoulding
- tensile strength
- tear resistance
- swelling after immersion in detergent
- abrasion loss
→ expected extended service life due to better abrasion resistance

- less ZnO necessary
- no DEG and no processing aid required
→ less raw materials have to be handled with
- higher filler loading



We supply material for good ideas!

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Internet: www.hoffmann-mineral.de
E-mail: info@hoffmann-mineral.com

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