Neuburg Siliceous Earth
in addition-cured, high consistency silicone rubber

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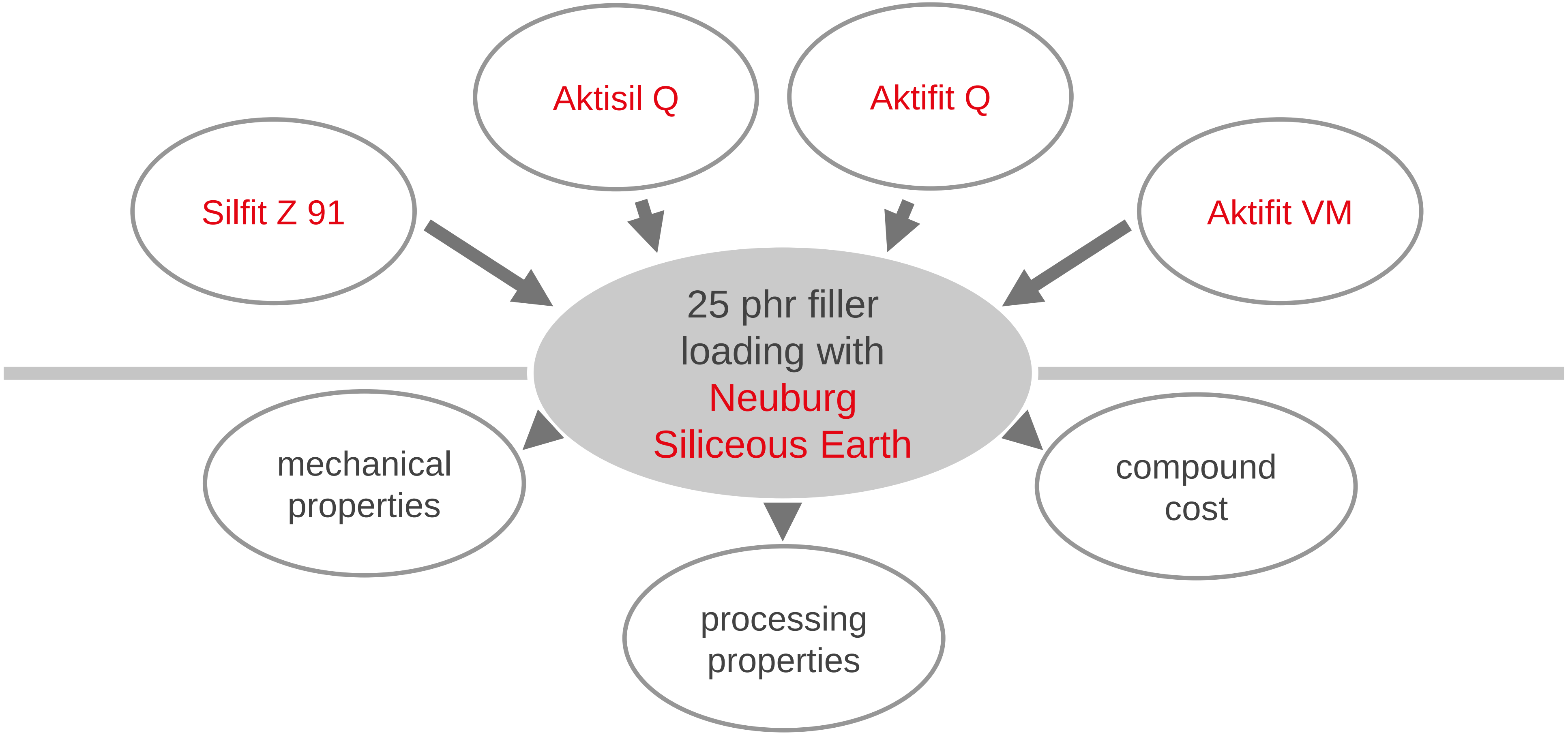
Wir geben Stoff für gute Ideen

Contents

Objective


Aktisil Q
Aktifit Q
Silfit Z 91
Aktifit VM
25 phr filler loading with Neuburg Siliceous Earth
mechanical properties
compound cost
processing properties

Fillers, Characteristics

	Particle size		Oil absorption	Density	Specific surface area BET	Calcination - Functionalization
	d_{50} [µm]	d_{97} [µm]	[g/100g]	[g/cm³]	[m²/g]	
Silfit Z 91	2.0	10	65	2.6	10	calcined
Aktisil Q	4.0	18	43	2.6	6	methacrylic functionalized
Aktifit Q	2.0	10	65	2.6	9	calcined, methacrylic functionalized
Aktifit VM	2.0	10	65	2.6	9	calcined, vinyl functionalized

Formulation

		phr
ELASTOSIL® R plus 4000/40 Wacker	two-component high consistency silicone rubber for molded articles hardness: 40 Shore A characteristics: high tear resistance	100
Neuburg Siliceous Earth (calcined/functionalized)	filler, based on corpuscular Neuburg Silica and lamellar kaolinite	25
Elastosil® AUX Batch PT 2 Wacker	platinum catalyst batch for molded articles	1.5

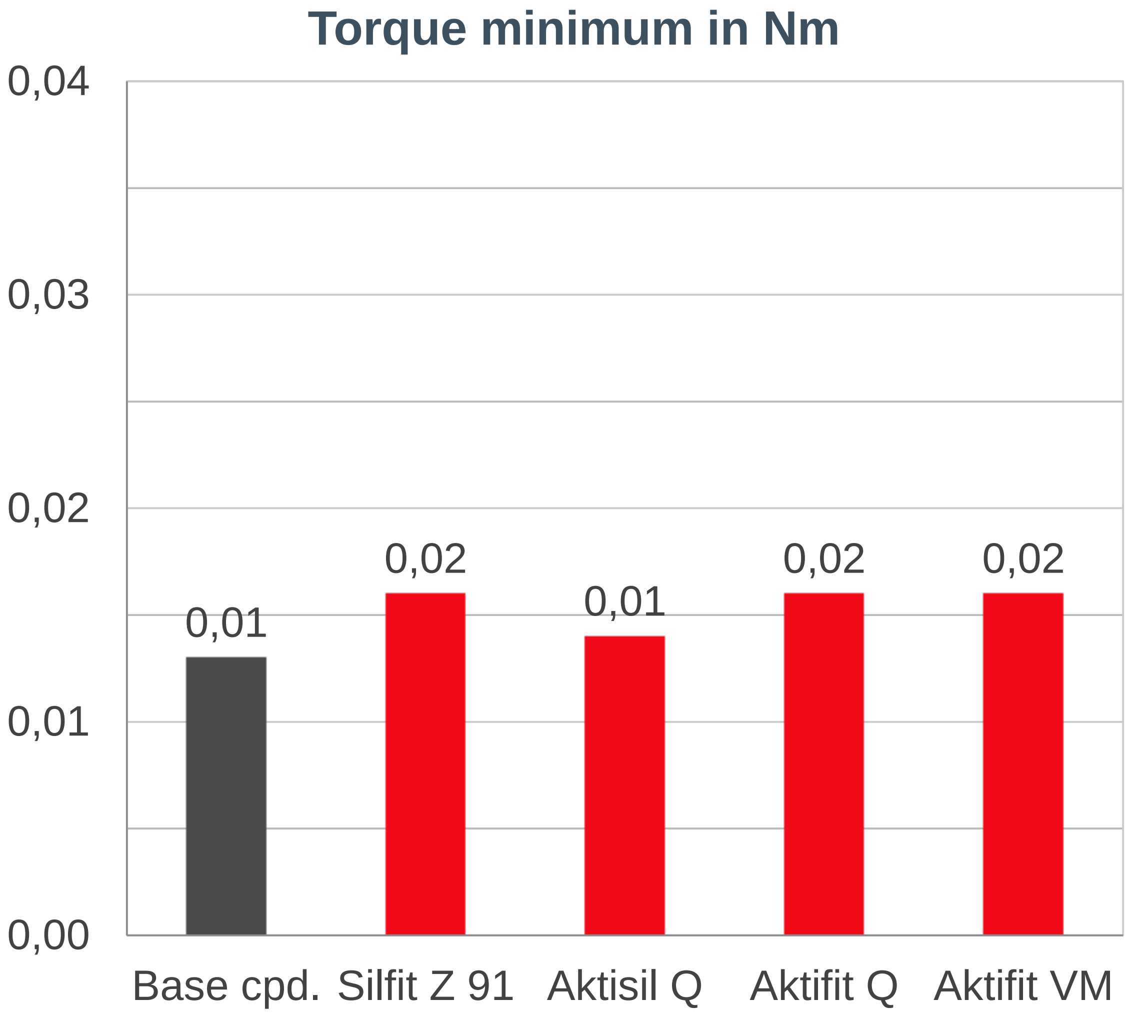
Compounding, vulcanization and post-cure parameters

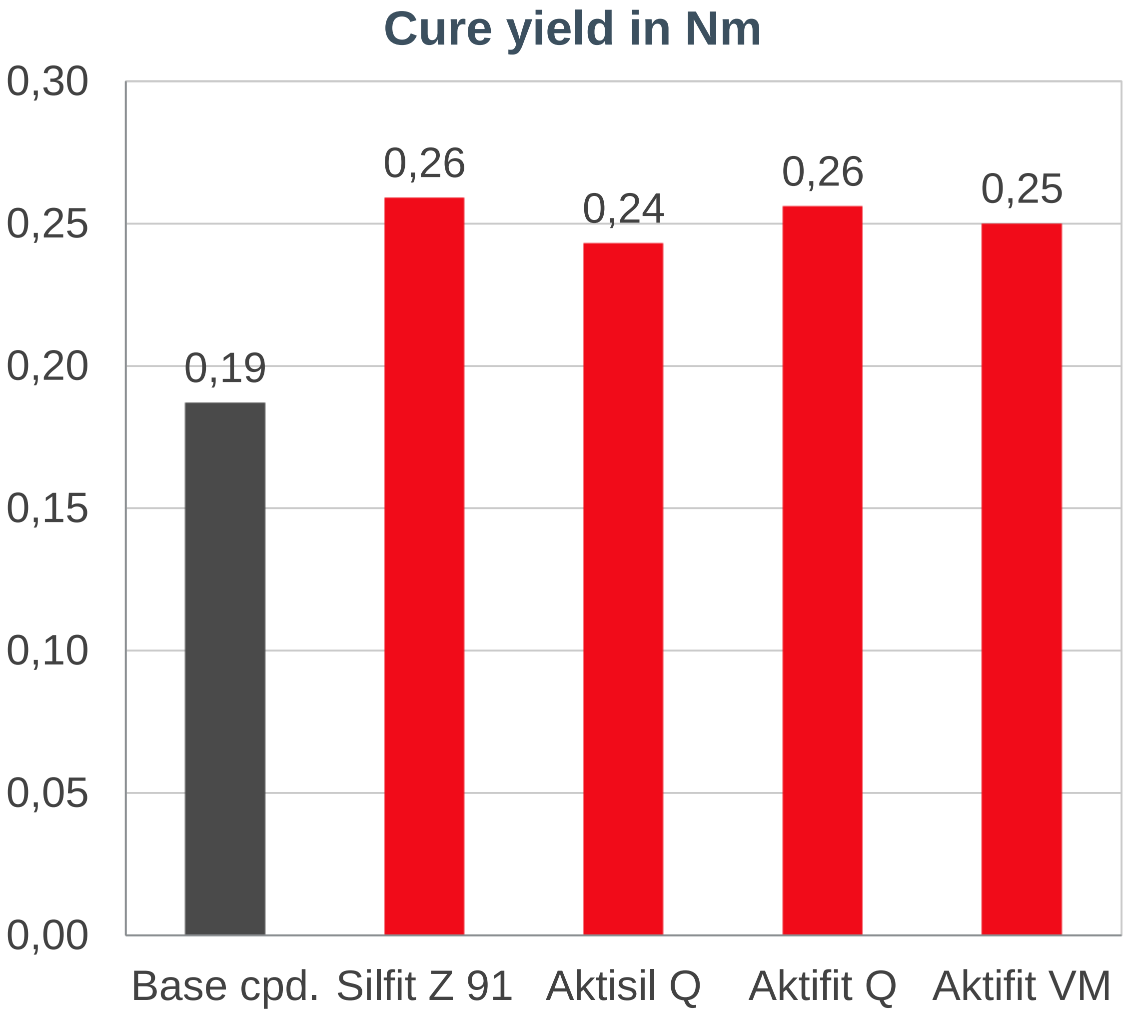
Compounding	
Open mill	Ø 150 x 300 mm
Batch weight	approx. 800 g
Mill temperature	25 °C
Mixing time	approx. 10 to 12 mins.

Vulcanization	
The curing was carried out in a press at 150 °C	
Curing time	5 minutes

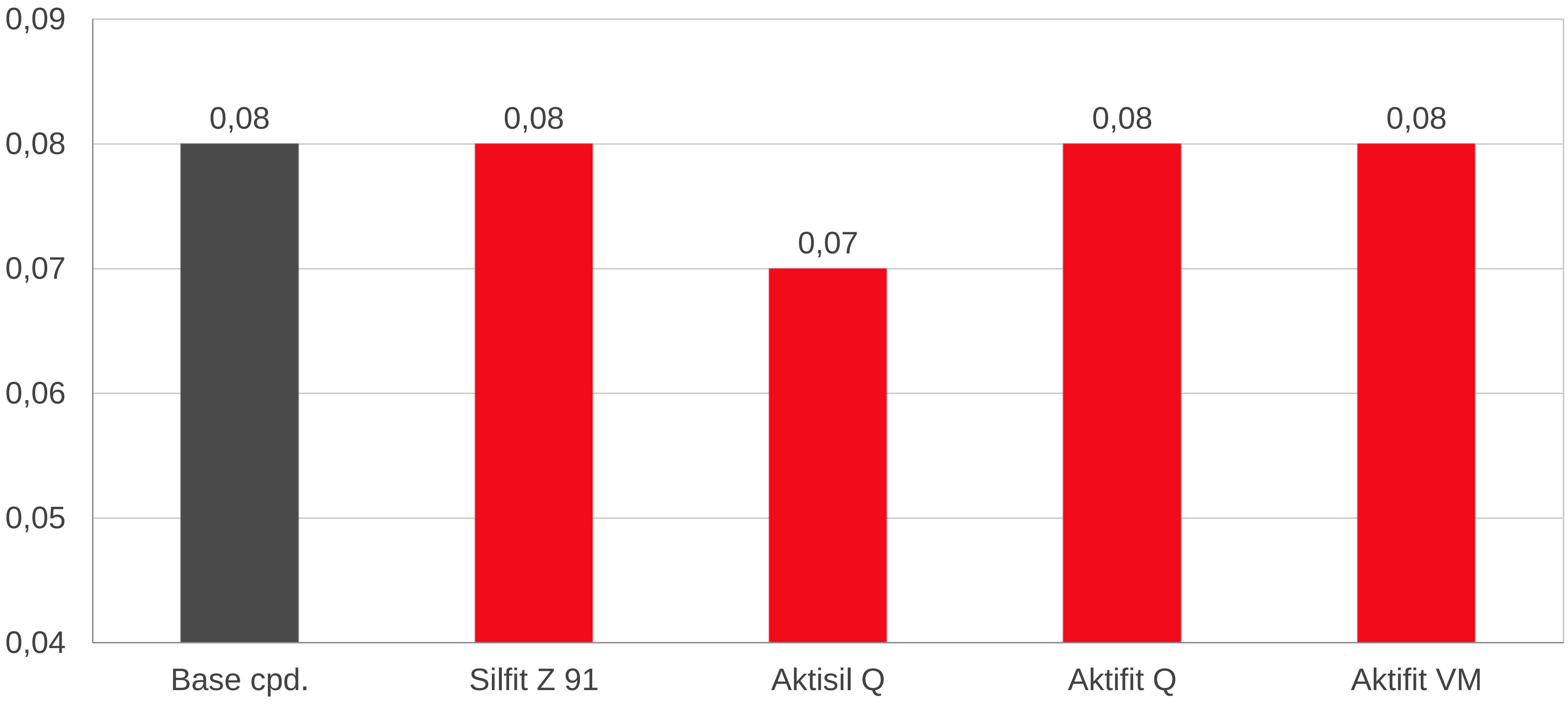
Post-cure parameters	
Temperature	200 °C
Duration	4 hours

Rotorless curemeter, 150 °C, 0.1° deflection

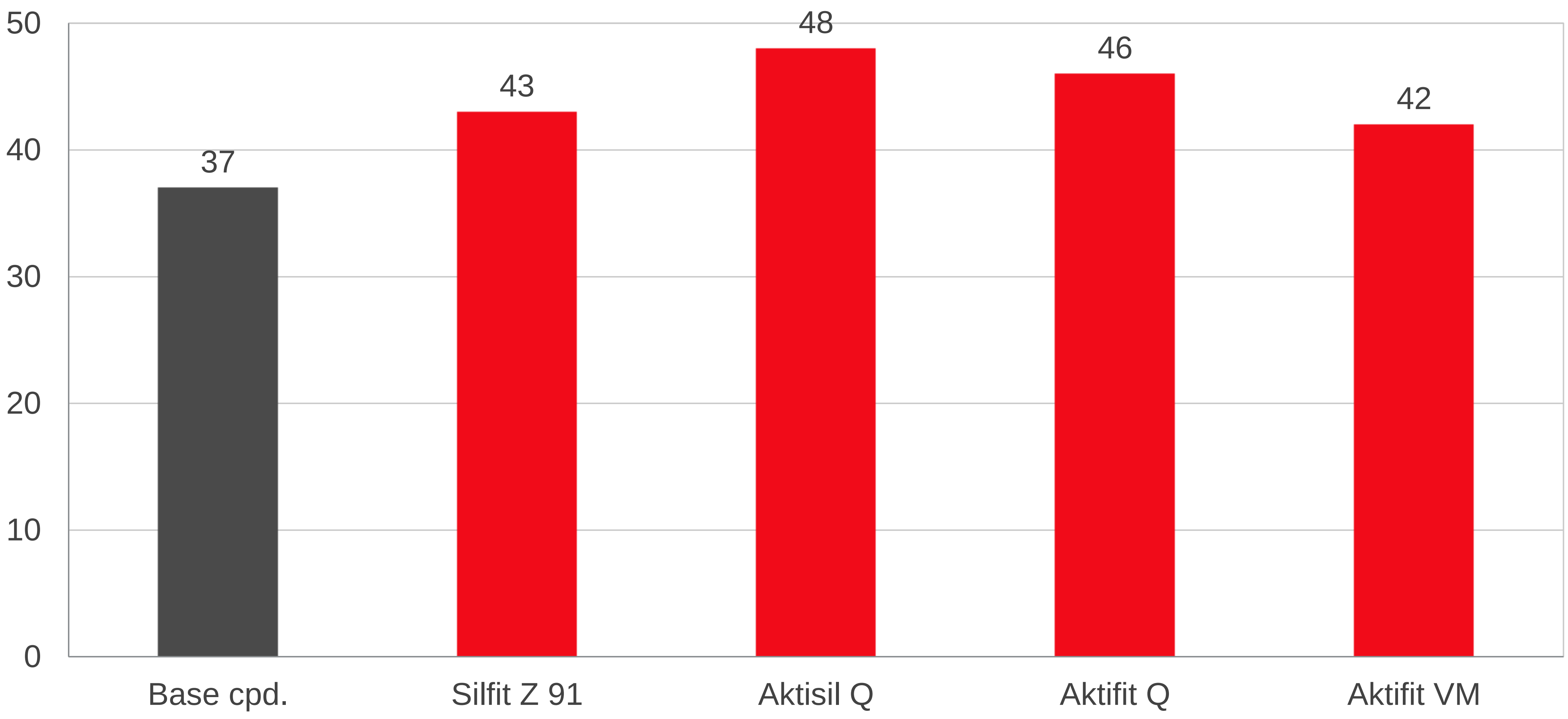




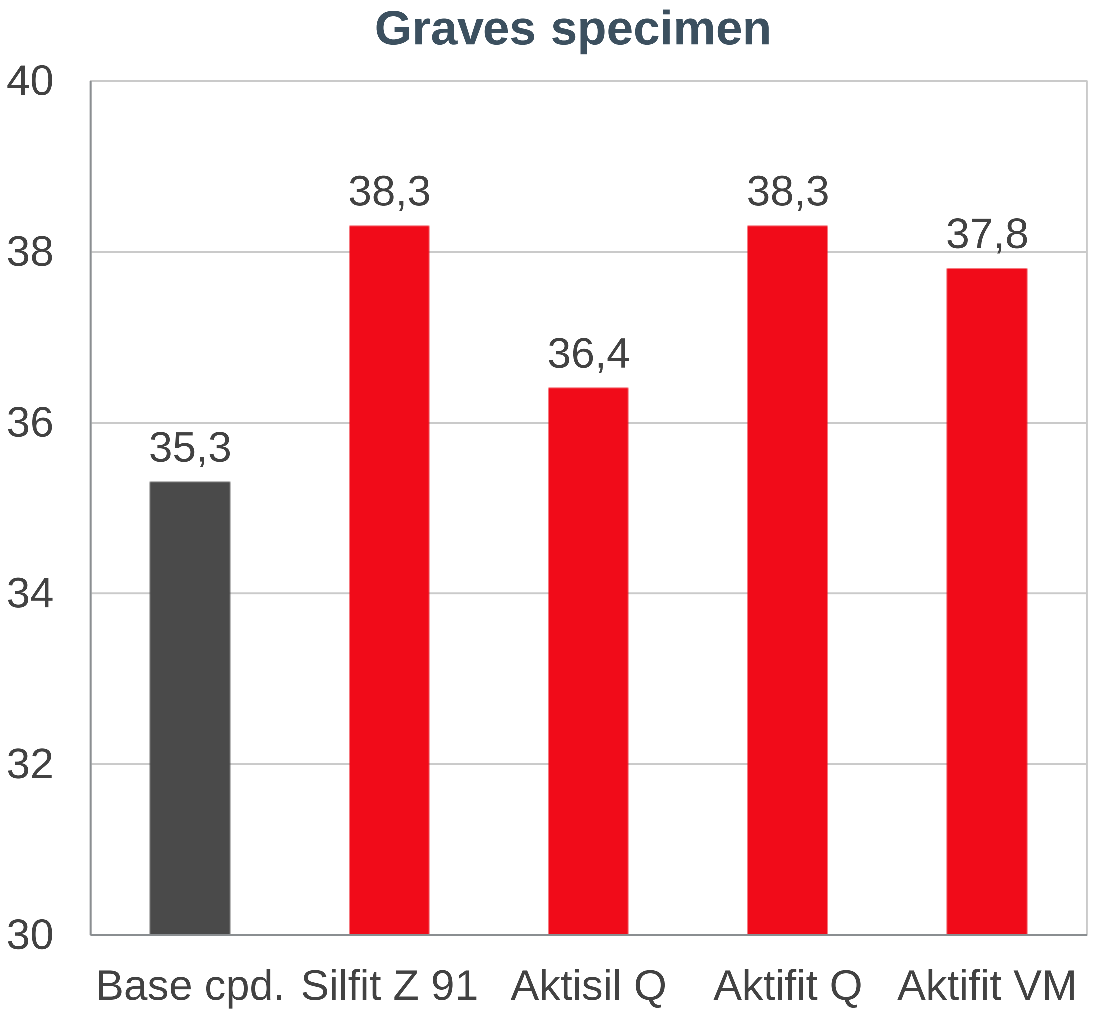
Rotorless curemeter, 150 °C, 0.1° deflection
tan δ, end of test



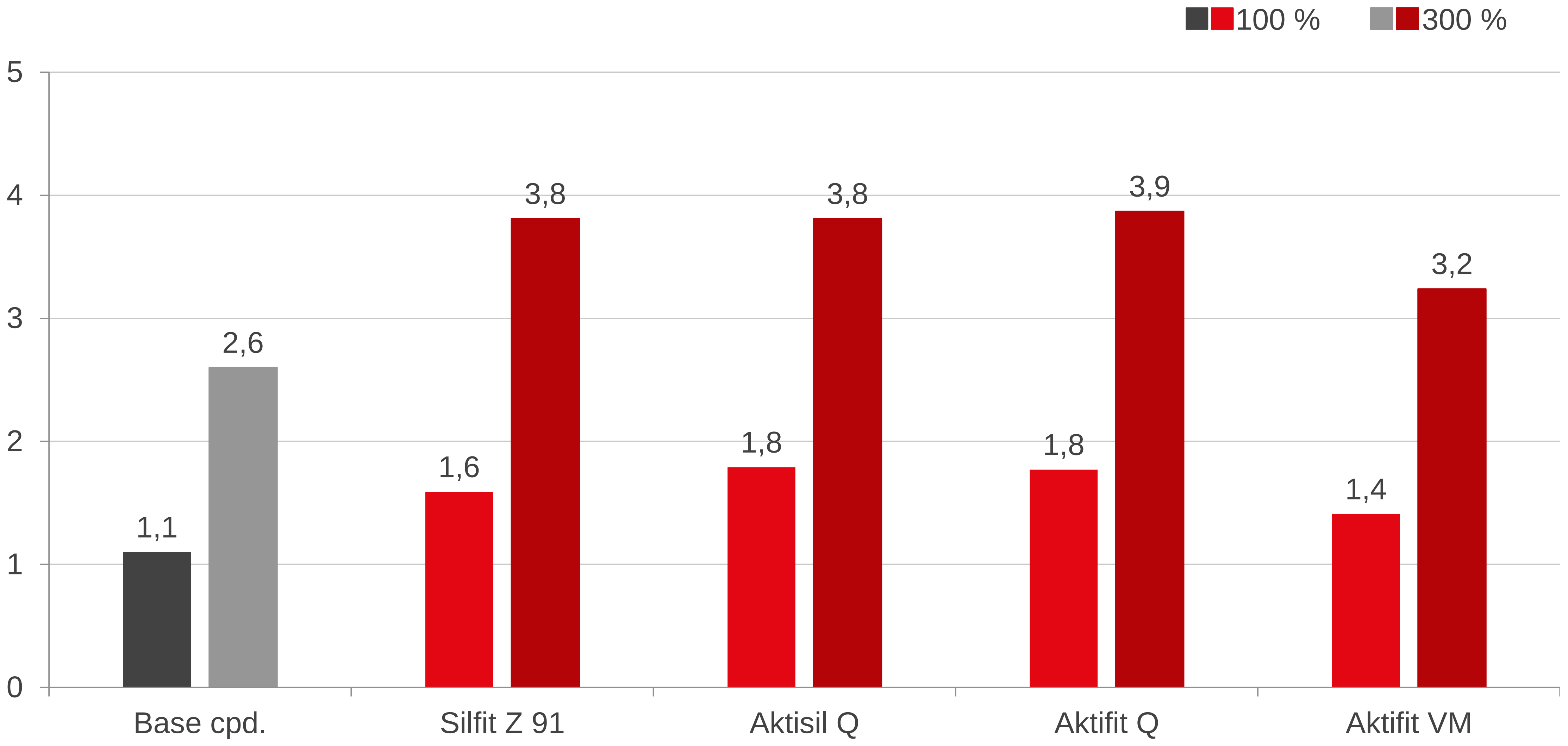
Hardness in Shore A
Piled-up S2 dumbbells



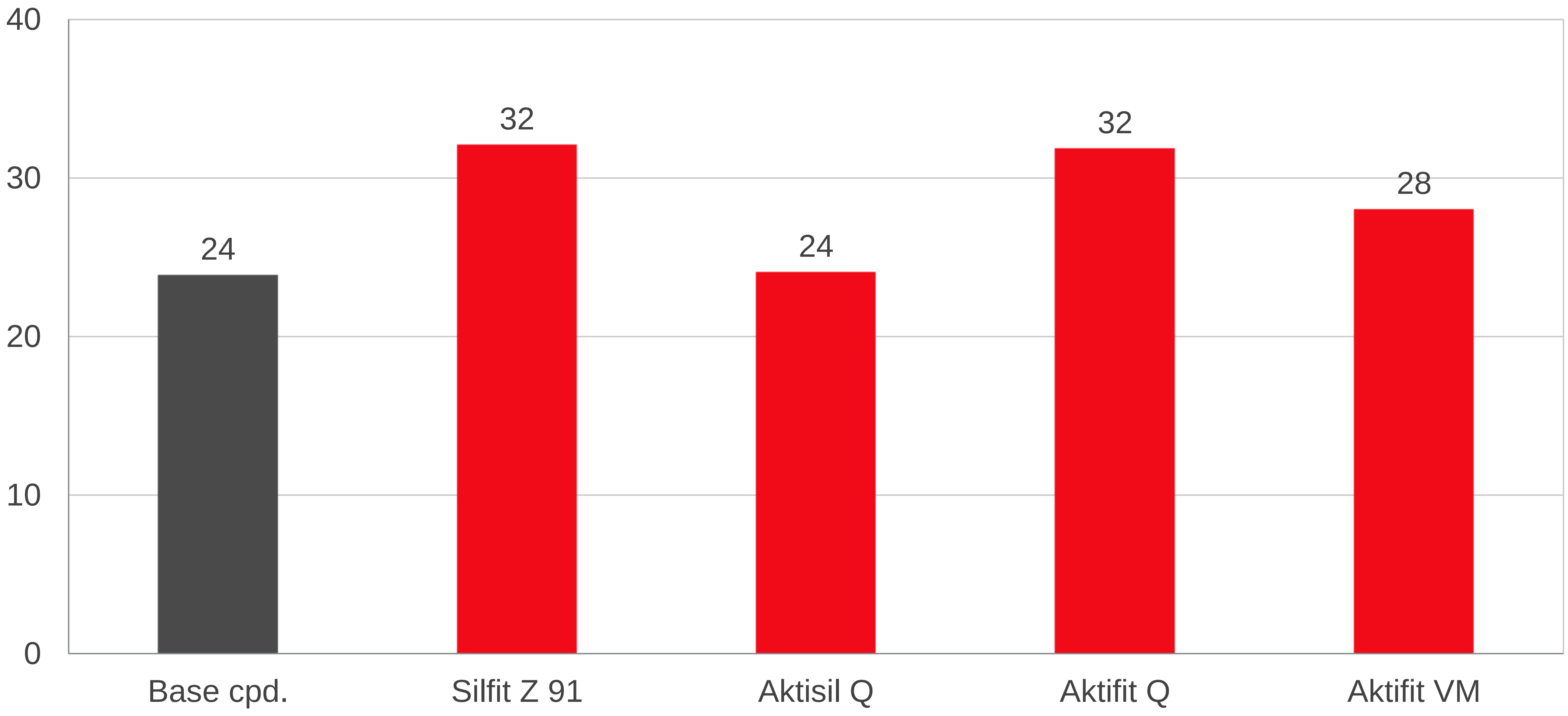
Tear resistance in N/mm



Tensile test with S2 dumbbells
Modulus 100 % & 300 % in MPa



Compression set in % (24 h / 175 °C / 25 % deformation)



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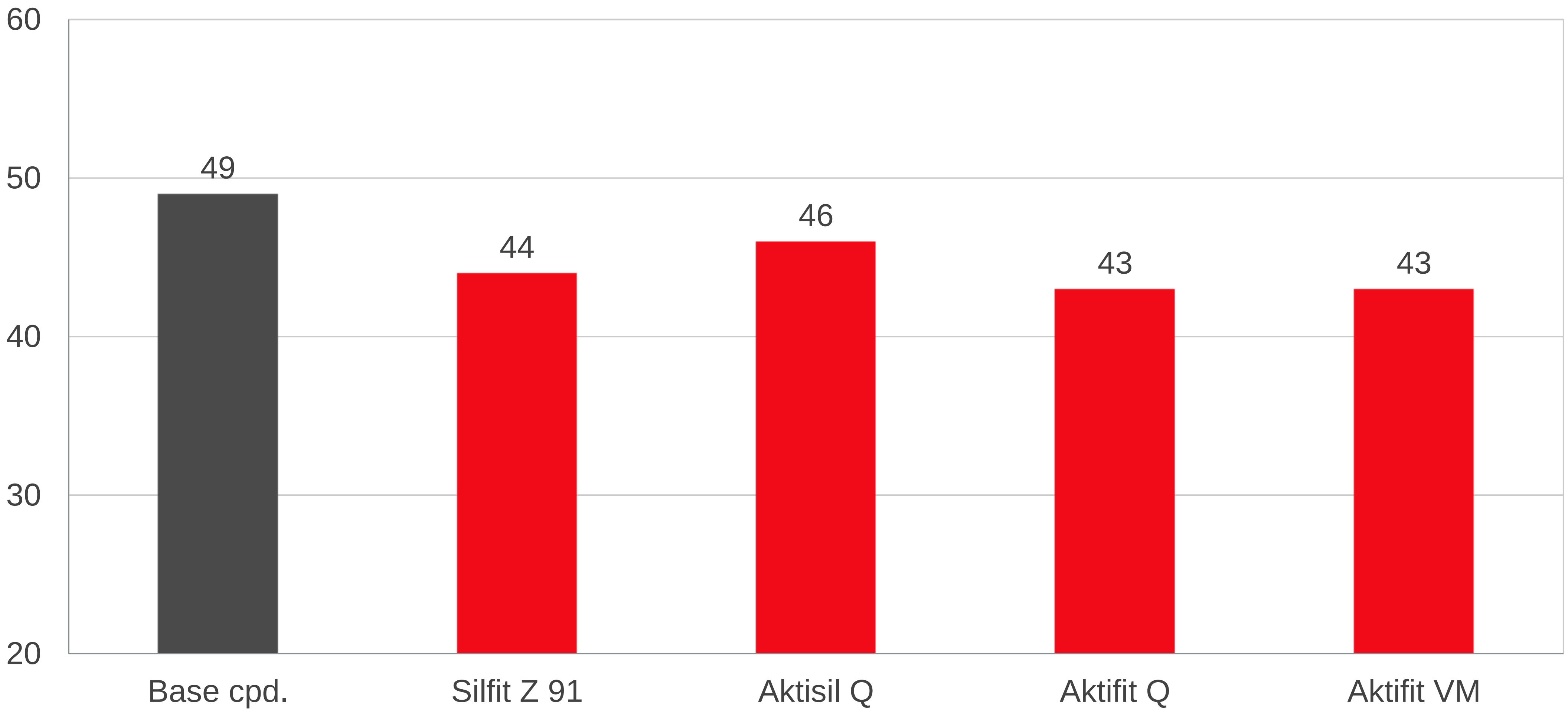
Rebound elasticity in %



Hot air aging
168 h / 200 °C

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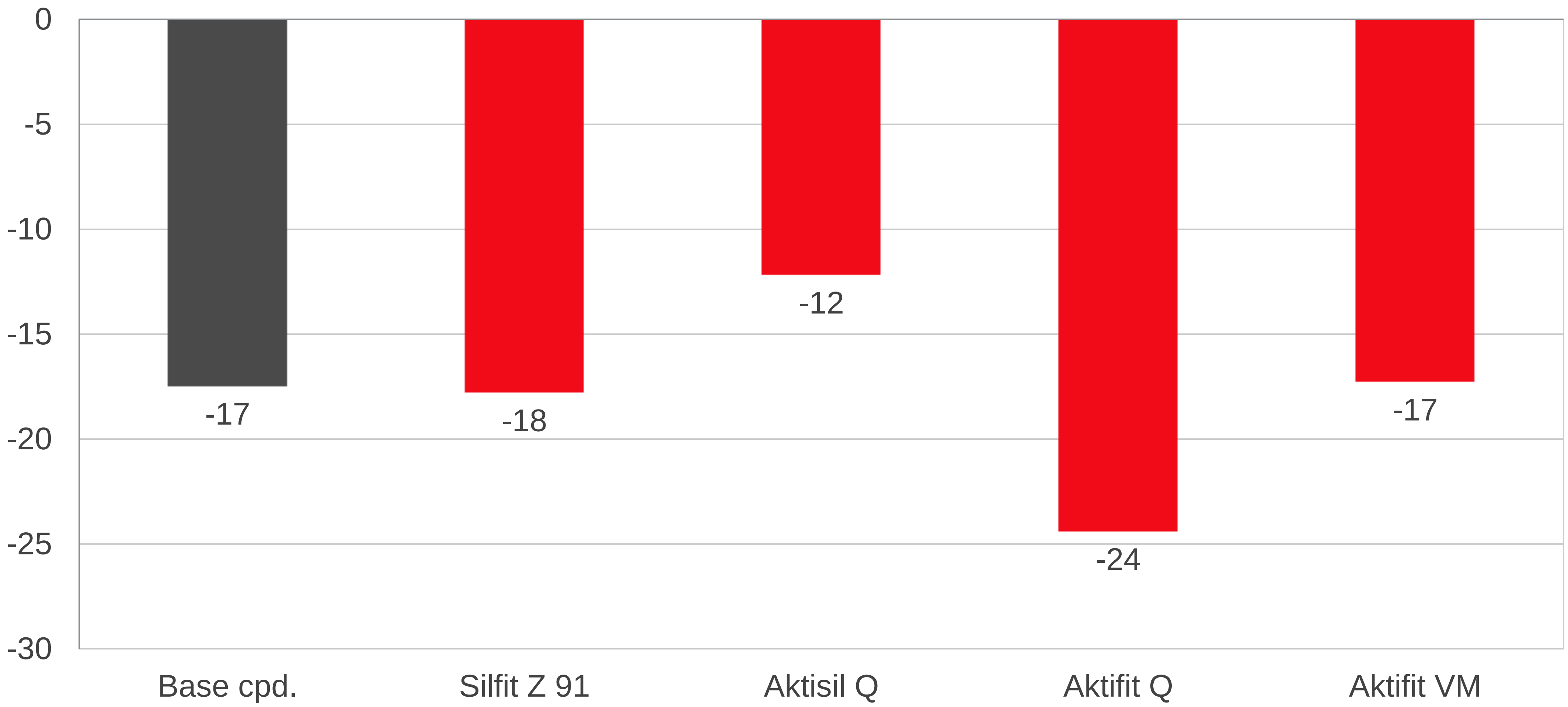
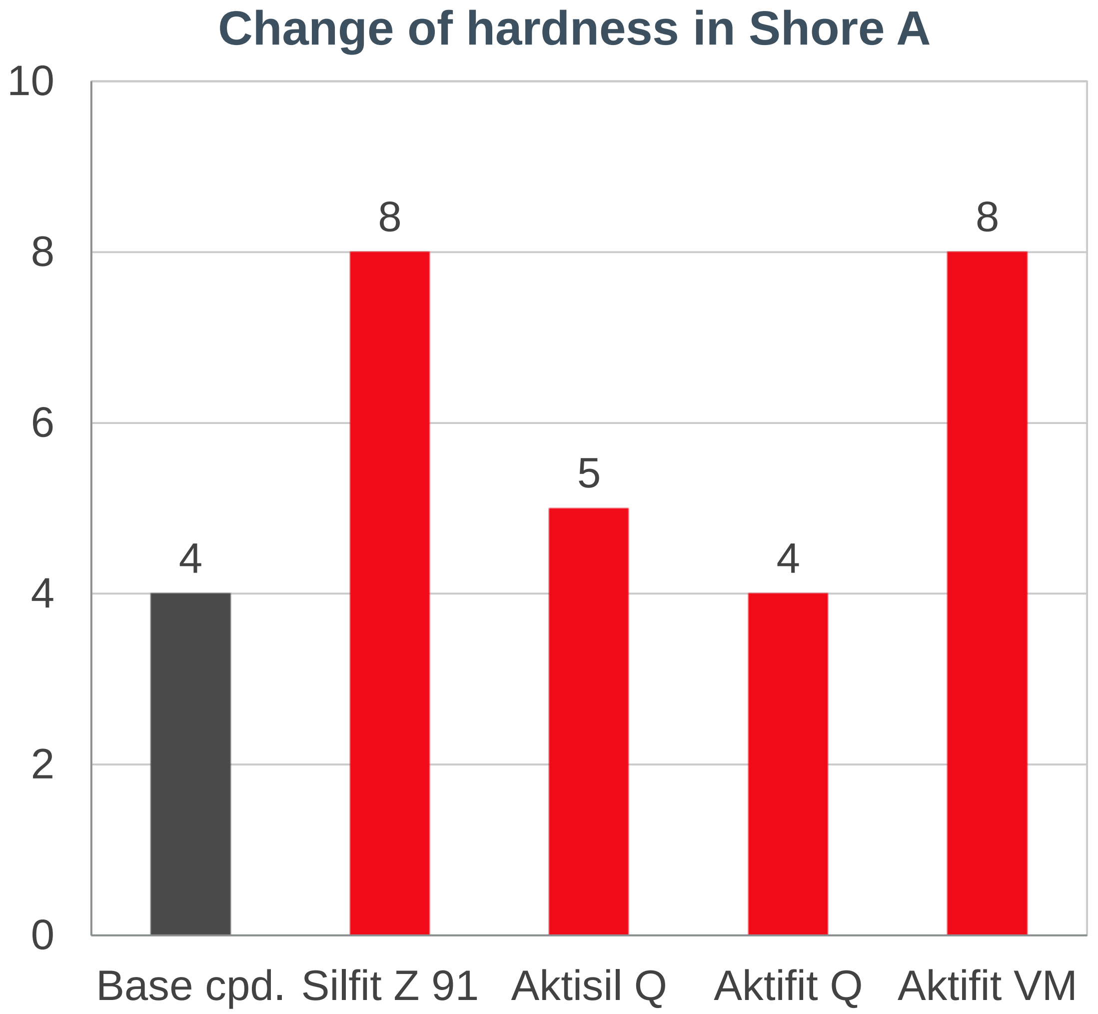
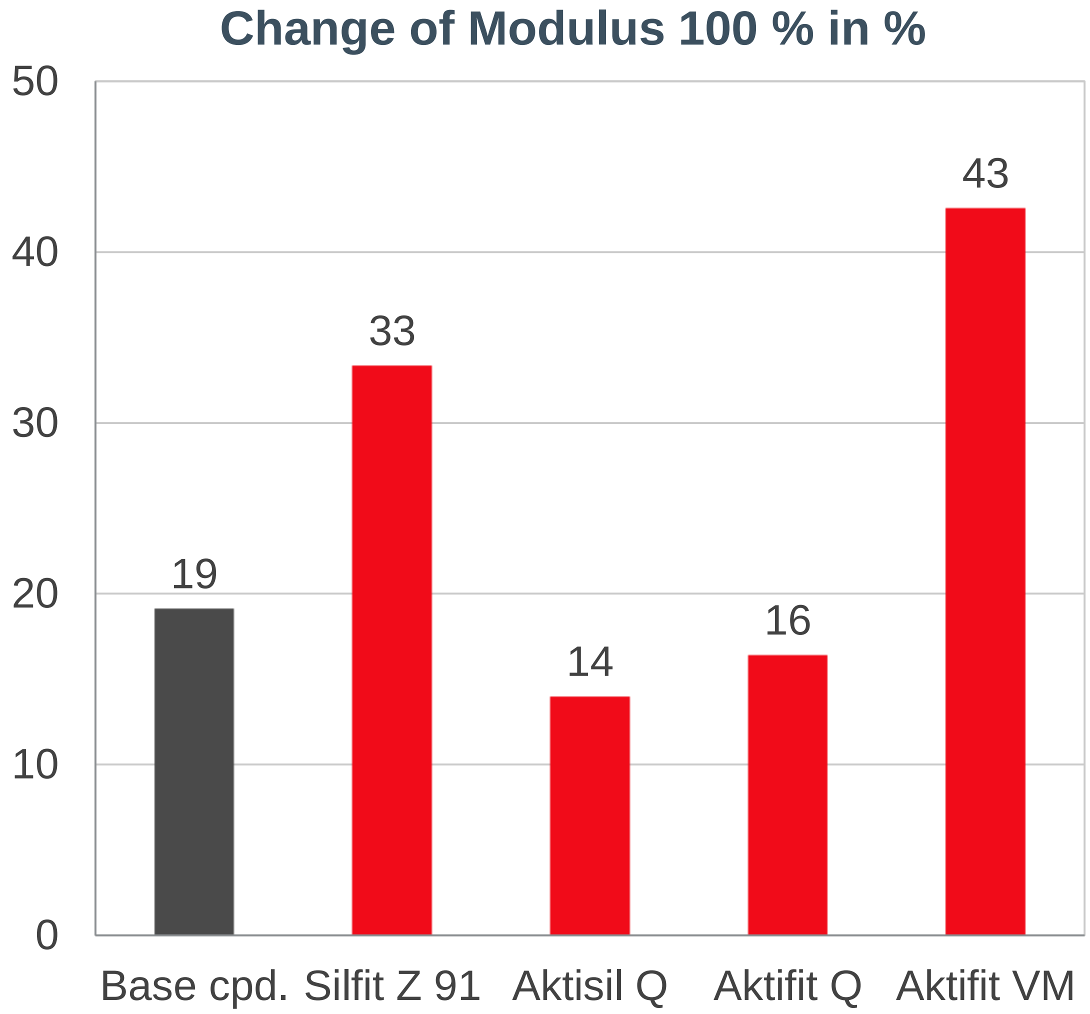
Hot air aging 168 h / 200 °C
Change of tear resistance (trousers) in %

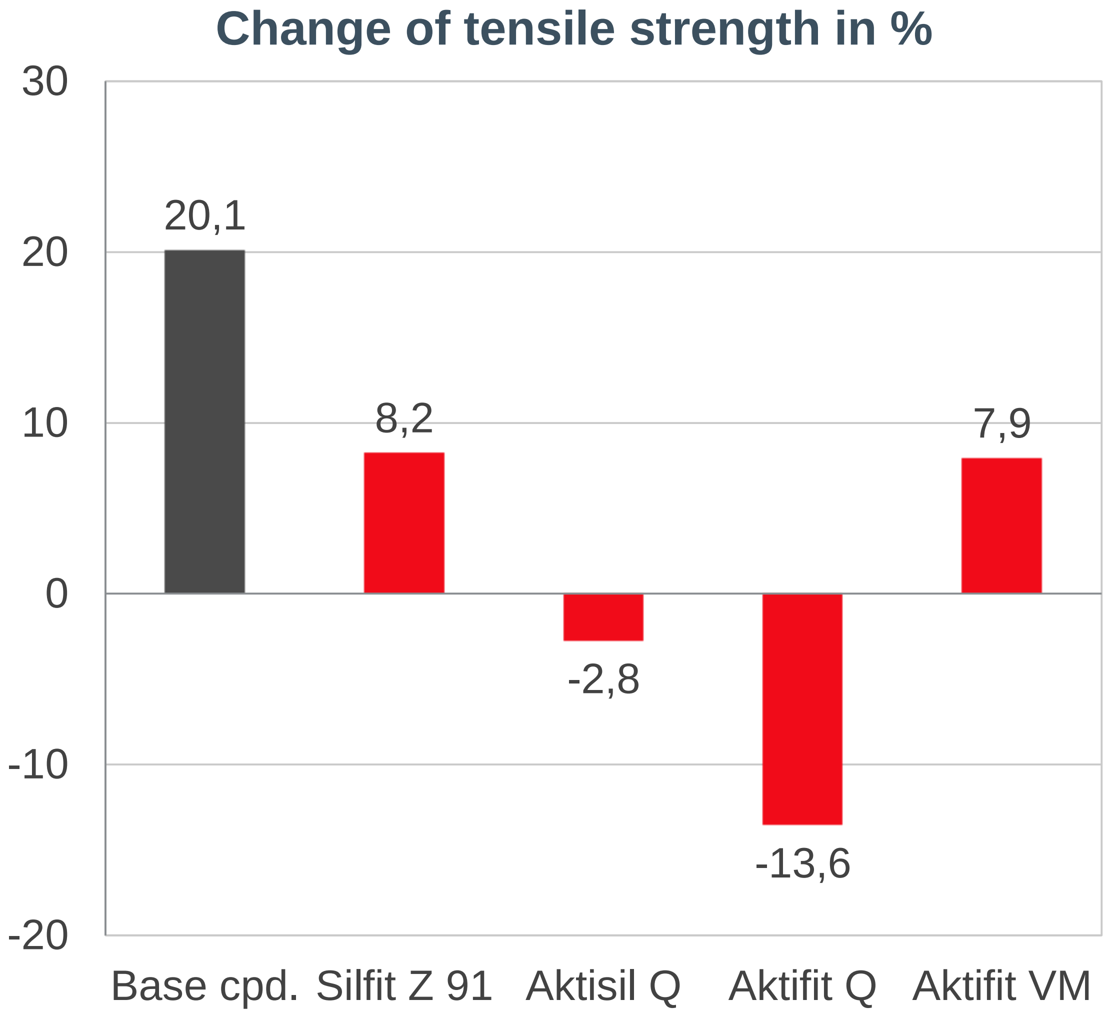


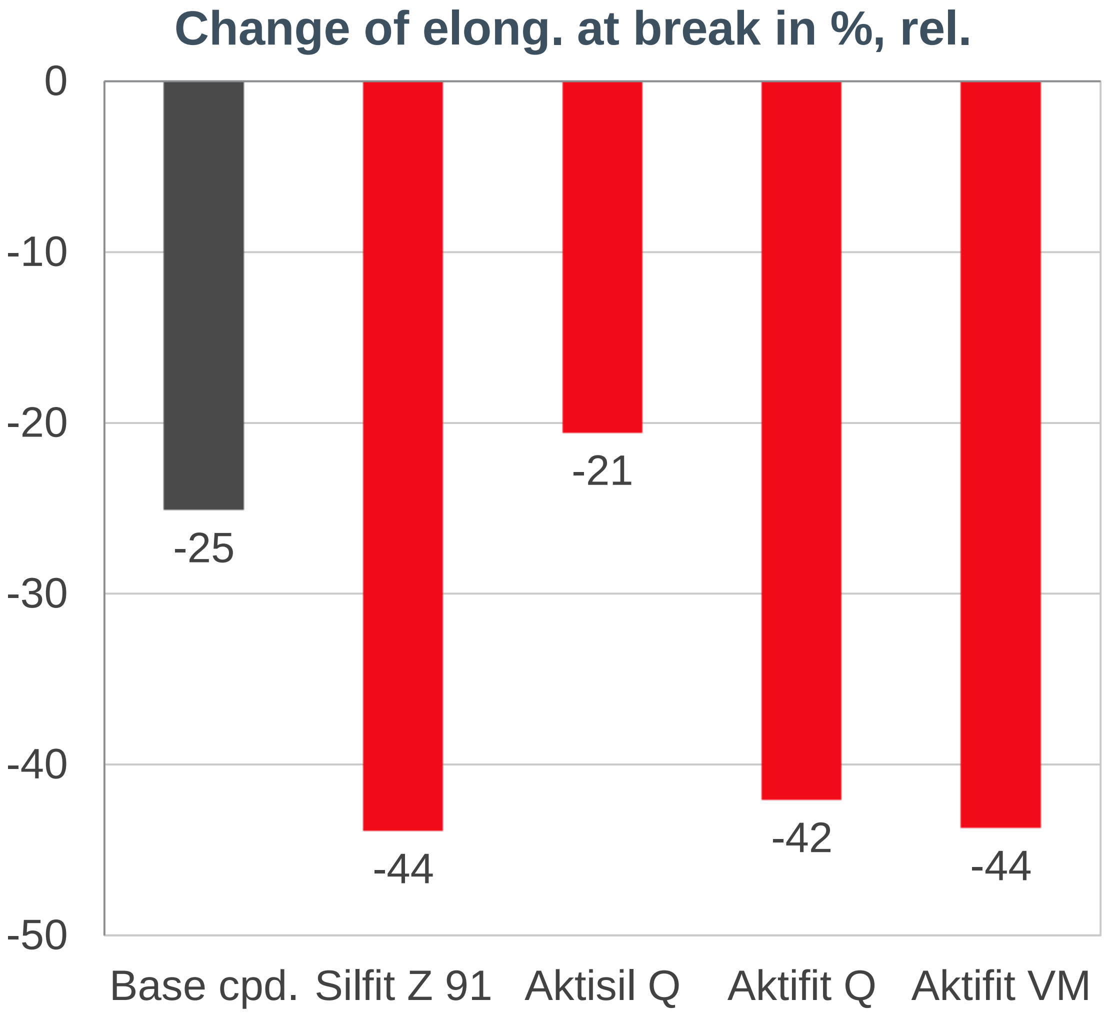
Hot air aging 168 h / 200 °C





Hot air aging 168 h / 200 °C

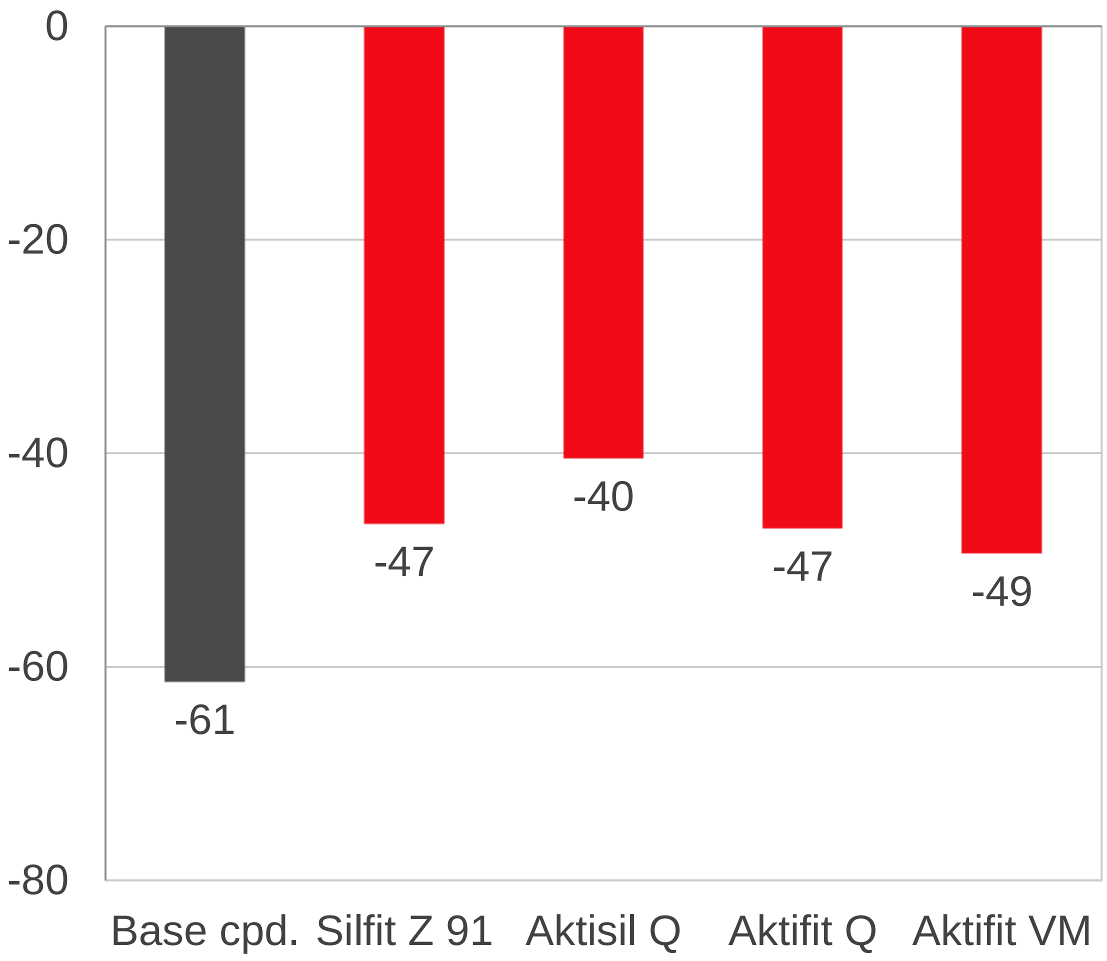




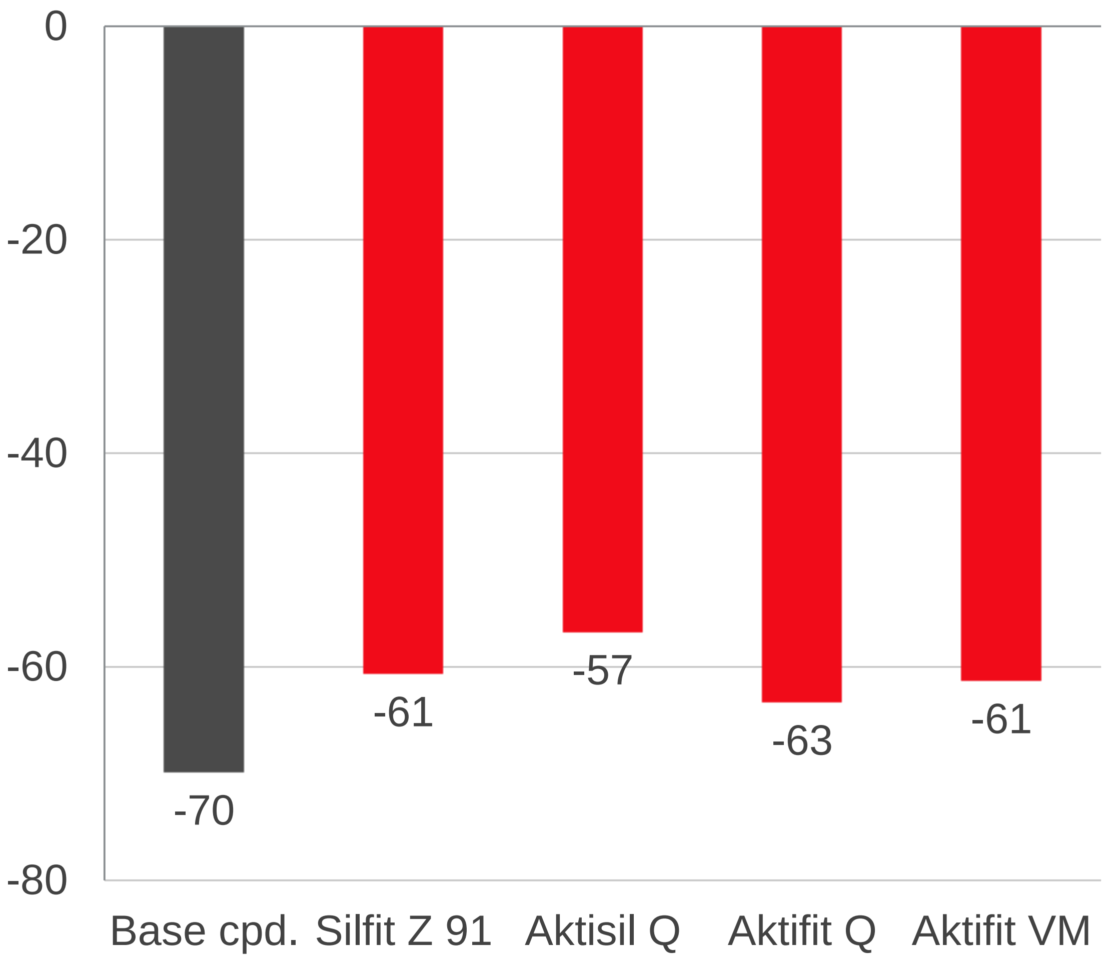
Immersion in reference oil IRM 903
72 h / 150 °C

Immersion in reference oil IRM 903
72 h / 150 °C

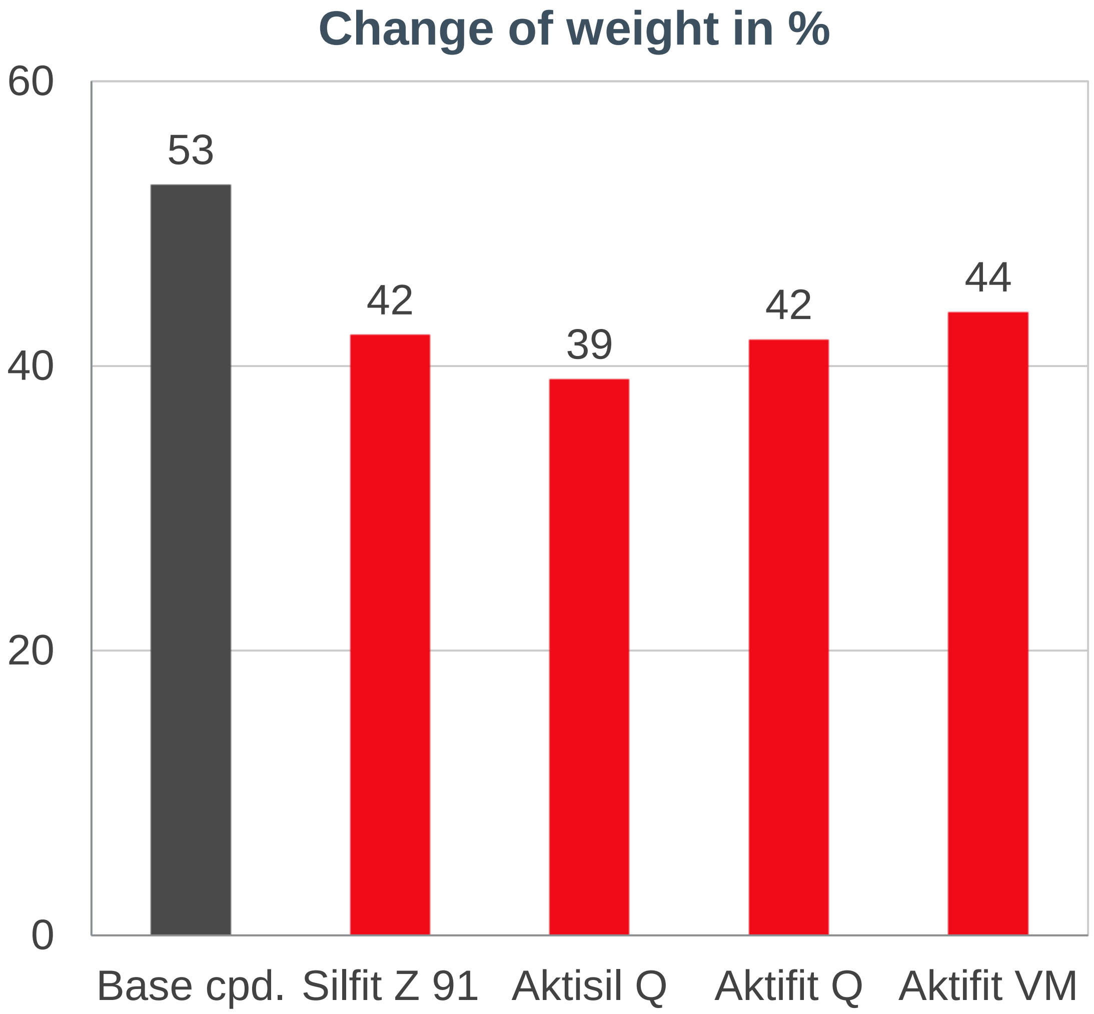
Change of tensile strength in %

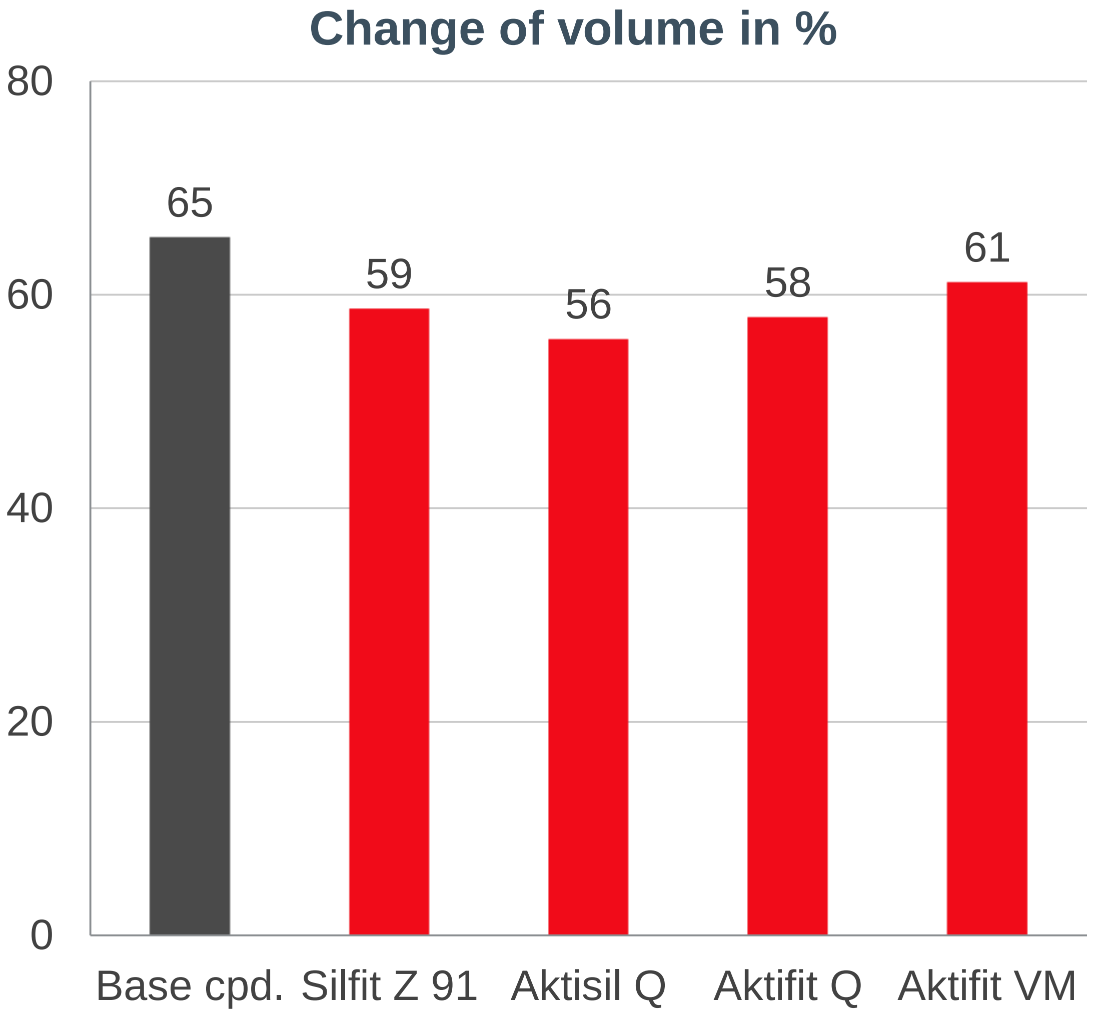


Change of elong. at break in %



Immersion in reference oil IRM 903
72 h / 150 °C





General benefits with 25 phr NSE vs. base compound

processing properties

- less stickiness and higher intrinsic strength of the non-cured compounds (green strength)

mechanical properties

- comparable or higher tear resistance
- higher modulus
- better oil resistance
- comparable hot air resistance

compound costs

- compound cost reduction potential

Product specific benefits with 25 phr NSE vs. base compound

	Silfit Z 91	Aktisil Q	Aktifit Q	Aktifit VM
reduction of stickiness	+	+	+	+
intrinsic strength of the non-cured compounds (green strength)	+	+	+	+
torque minimum	=	=	=	=
cure yield	+	+	+	+
tear resistance trousers	=		=	
tear resistance graves	**+**	=	**+**	+
modulus	+	**+**	**+**	+
compression set		=		
hot air resistance		**+**		
oil resistance	+	**+**	+	+

+ ≈ better than base compound **+** ≈ best product = ≈ comparable to base compound

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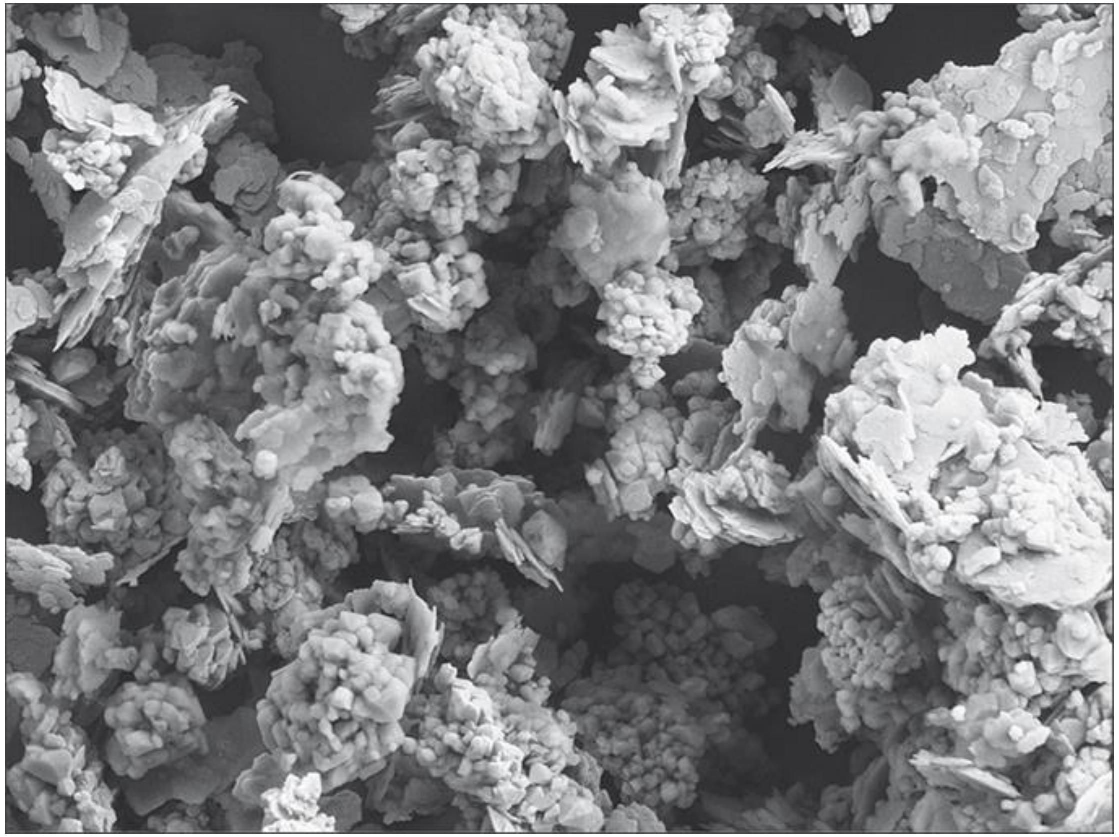
Test standards – overview

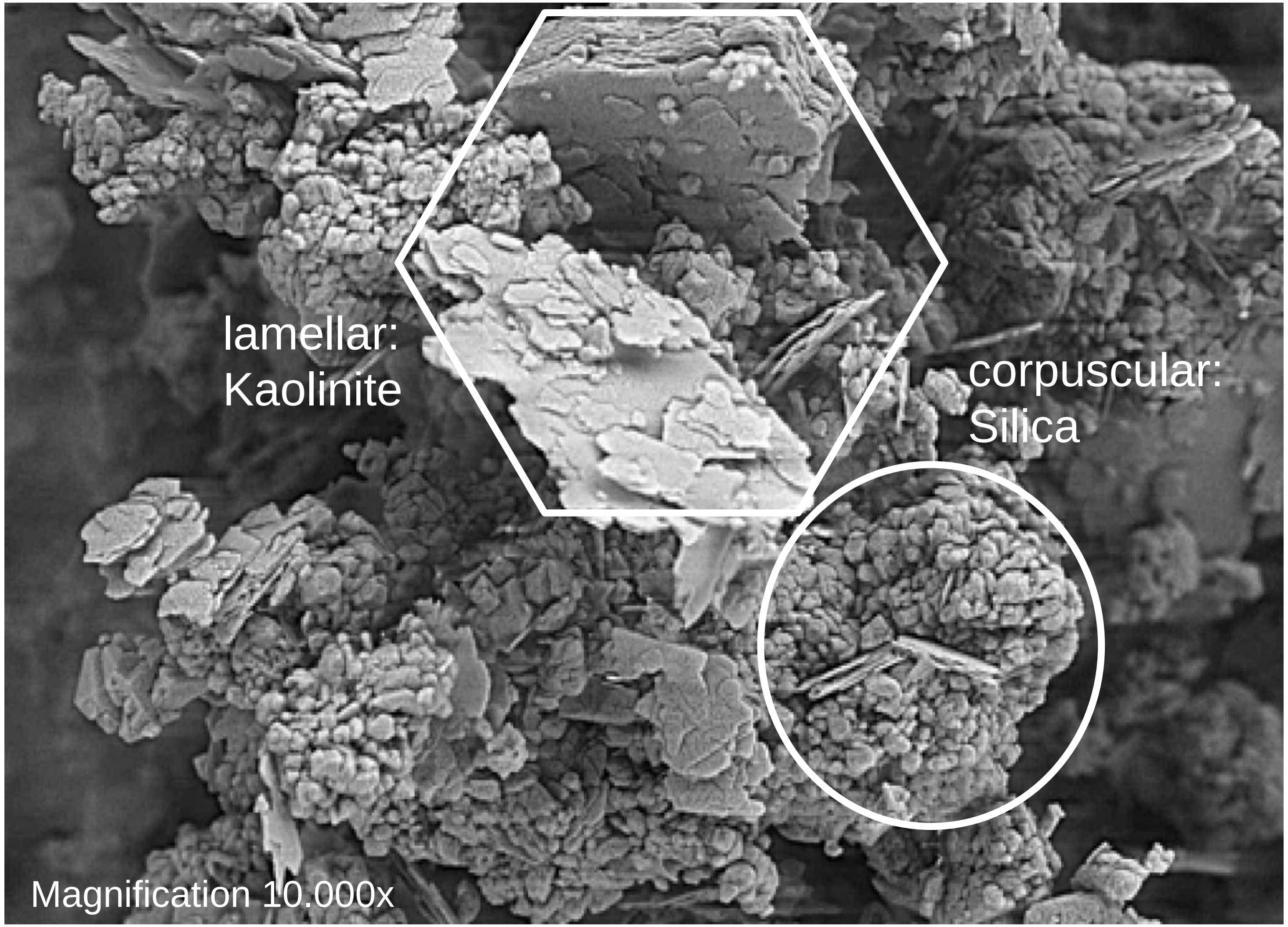
Testing	Standard
Cure characteristics	DIN 53 529, part 1 – 4
Tensile test	DIN 53 504, S2
Compression set	DIN ISO 815-1, Type B
Hardness	DIN ISO 7619-1
Rebound elasticity	DIN 53 512
Tear resistance - Trousers specimen	DIN ISO 34-1, A
Tear resistance - Graves specimen	DIN ISO 34-1, Bb
Resistance to liquid media	DIN ISO 1817
Resistance to air	ISO 188, D

Neuburg Siliceous Earth



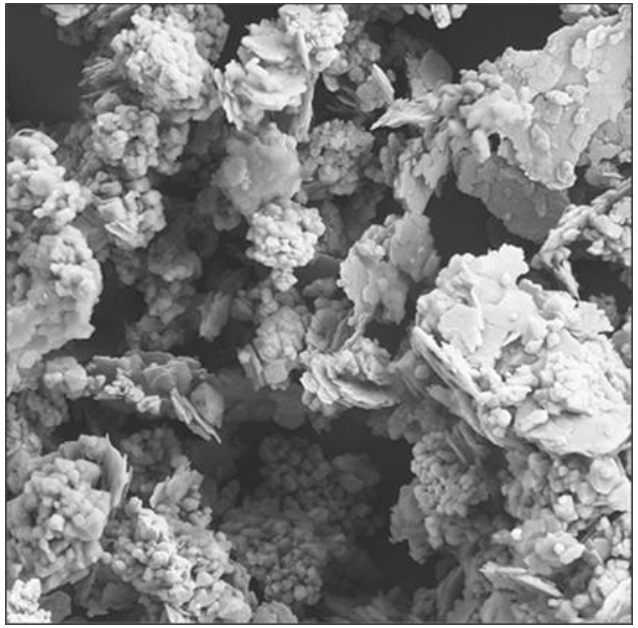
A natural combination of corpuscular Neuburg silica and lamellar kaolinite: a loose mixture impossible to separate by physical methods. The silica portion exhibits a round grain shape and consists of aggregated primary particles of about 200 nm diameter.

Morphology of Neuburg Siliceous Earth



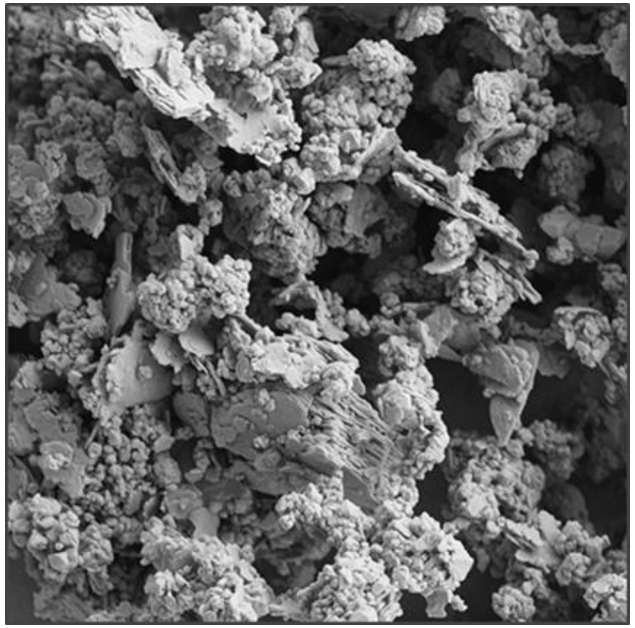
Calcined Neuburg Siliceous Earth

A downstream thermal process lead to the calcined products SILFIT and AKTIFIT, based on SILLITIN Z 86.



Neuburg Siliceous Earth

Calcination Process →



Calcined Neuburg Siliceous Earth

Additional application benefits, as well as the removing of crystal water included in the kaolinite. The silica part remains inert.

back to formulation

Results in tabular form

Results in tabular form

		Base cpd.	Silfit Z 91	Aktisil Q	Aktifit Q	Aktifit VM
Rheology						
Torque minimum	Nm	0.013	0.016	0.014	0.016	0.016
Torque maximum	Nm	0.200	0.275	0.257	0.272	0.266
Cure yield	Nm	0.187	0.259	0.243	0.256	0.250
Curing time	mins.	5.00	5.00	5.00	5.00	5.00
Tan δ		0.08	0.08	0.07	0.08	0.08
Vulcanisate – post-cured 4 h / 200 °C						
Hardness	Shore A	37	43	48	46	42
Tensile strength	MPa	7.9	6.2	5.8	6.3	5.8
Elongation at break	%	887	637	629	676	739
Modulus 100 %	MPa	1.1	1.6	1.8	1.8	1.4
Modulus 300 %	MPa	2.6	3.8	3.8	3.9	3.2
Tear resistance trousers	N/mm	20.6	20.8	19.7	20.9	19.1
Tear resistance graves	N/mm	35.3	38.3	36.4	38.3	37.8
Compression set (24 h / 175 °C / 25 % def.)	%	24	32	24	32	28
Rebound elasticity	%	49	44	46	43	43

Results in tabular form

		Base cpd.	Silfit Z 91	Aktisil Q	Aktifit Q	Aktifit VM
Hot air aging 168 h / 200 °C						
Hardness	Shore A	41	51	53	50	50
Tensile strength	MPa	9.5	6.7	5.6	5.4	6.3
Elongation at break	%	664	357	500	391	416
Modulus 100 %	MPa	1.3	2.1	2.0	2.1	2.0
Modulus 300 %	MPa	3.5	5.9	4.4	4.7	4.9
Tear resistance trousers	N/mm	17.0	17.1	17.3	15.8	15.8
Tear resistance graves	N/mm	31.3	31.8	29.0	28.0	33.7
Rebound elasticity	%	46	41	43	42	44
ΔHardness	Shore A	4	8	5	4	8
ΔTensile strength	%	20.1	8.2	-2.8	-13.6	7.9
ΔElongation at break	%, rel.	-25.1	-43.9	-20.6	-42.1	-43.7
ΔModulus 100 %	%	19.1	33.3	25.0	16.4	42.6
ΔModulus 300 %	%	34.6	53.5	15.0	22.5	52.5
ΔTear resistance trousers	%	-17.5	-17.8	-12.2	-24.4	-17.3
ΔTear resistance graves	%	-11.3	-17.0	-20.3	-26.9	-10.8
ΔRebound elasticity	%, rel.	-6.1	-6.8	-6.5	-2.3	2.3

Results in tabular form

		Base cpd.	Silfit Z 91	Aktisil Q	Aktifit Q	Aktifit VM
Immersion in reference oil IRM 903 72 h / 150 °C						
Hardness	Shore A	23	28	31	28	26
Tensile strength	MPa	3.1	3.3	3.4	3.3	2.9
Elongation at break	%	267	251	272	248	286
Modulus 100 %	MPa	1.3	1.7	1.9	1.7	1.3
ΔHardness	Shore A	-14	-15	-17	-18	-16
ΔTensile strength	%	-61.4	-46.6	-40.5	-47.0	-49.4
ΔElongation at break	%, rel.	-69.9	-60.7	-56.8	-63.3	-61.3
ΔModulus 100 %	%	14.5	6.3	7.3	-6.8	-6.4
ΔWeight	%	53	42	39	42	44
ΔVolume	%	65	59	56	58	61