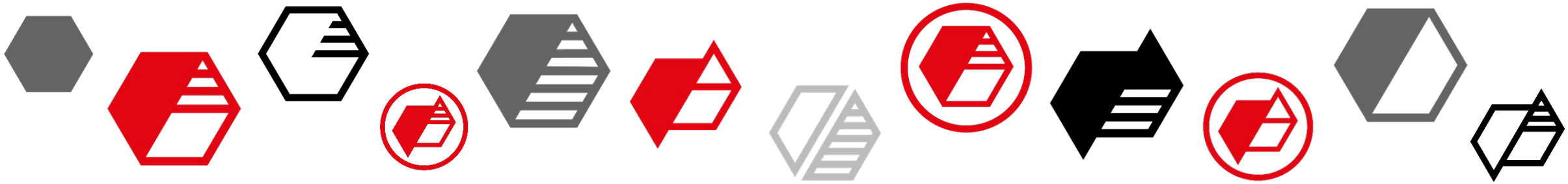

Neuburg Siliceous Earth
as a tintable alternative to carbon black N 990
in bisphenolic-cured FKM

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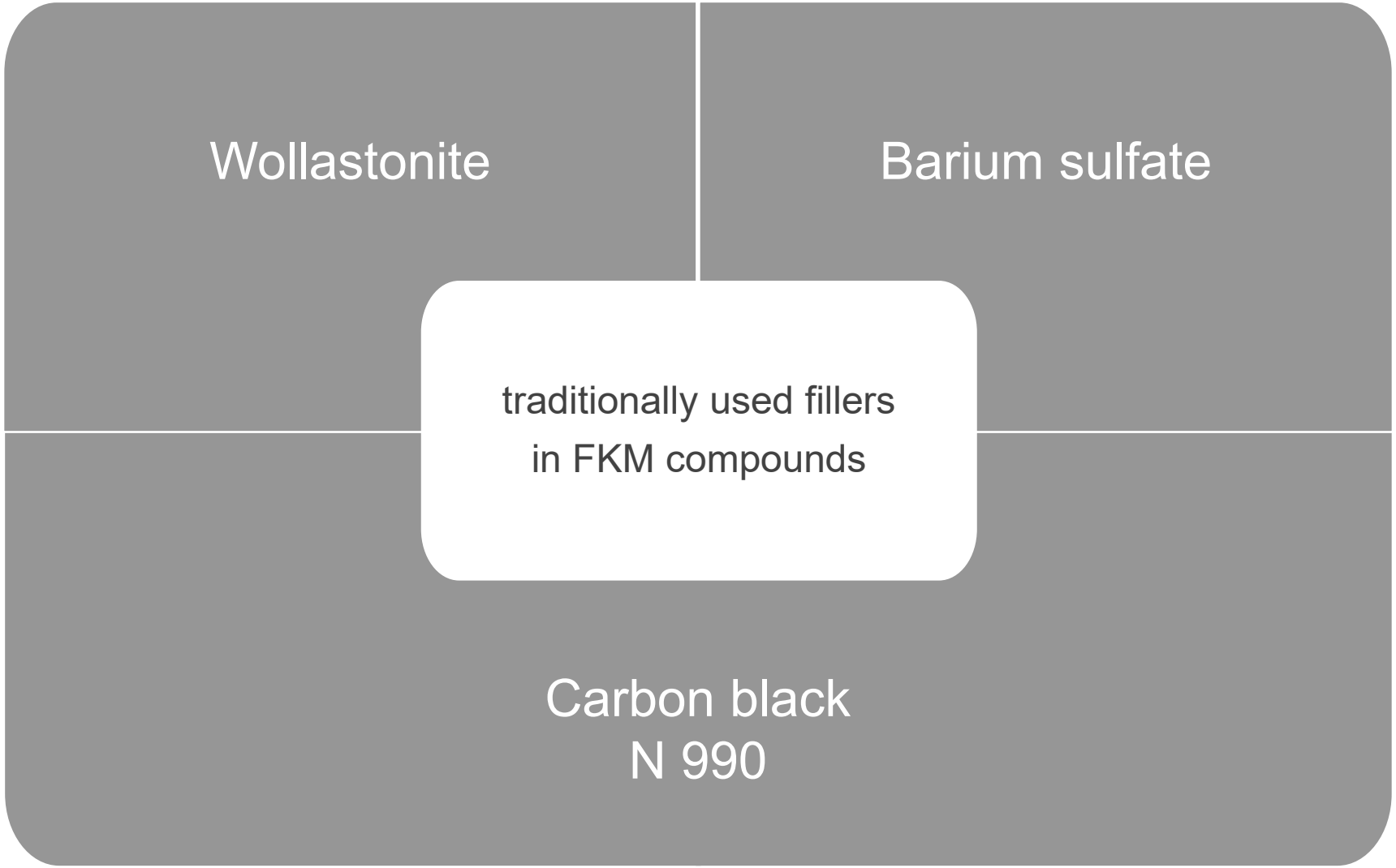
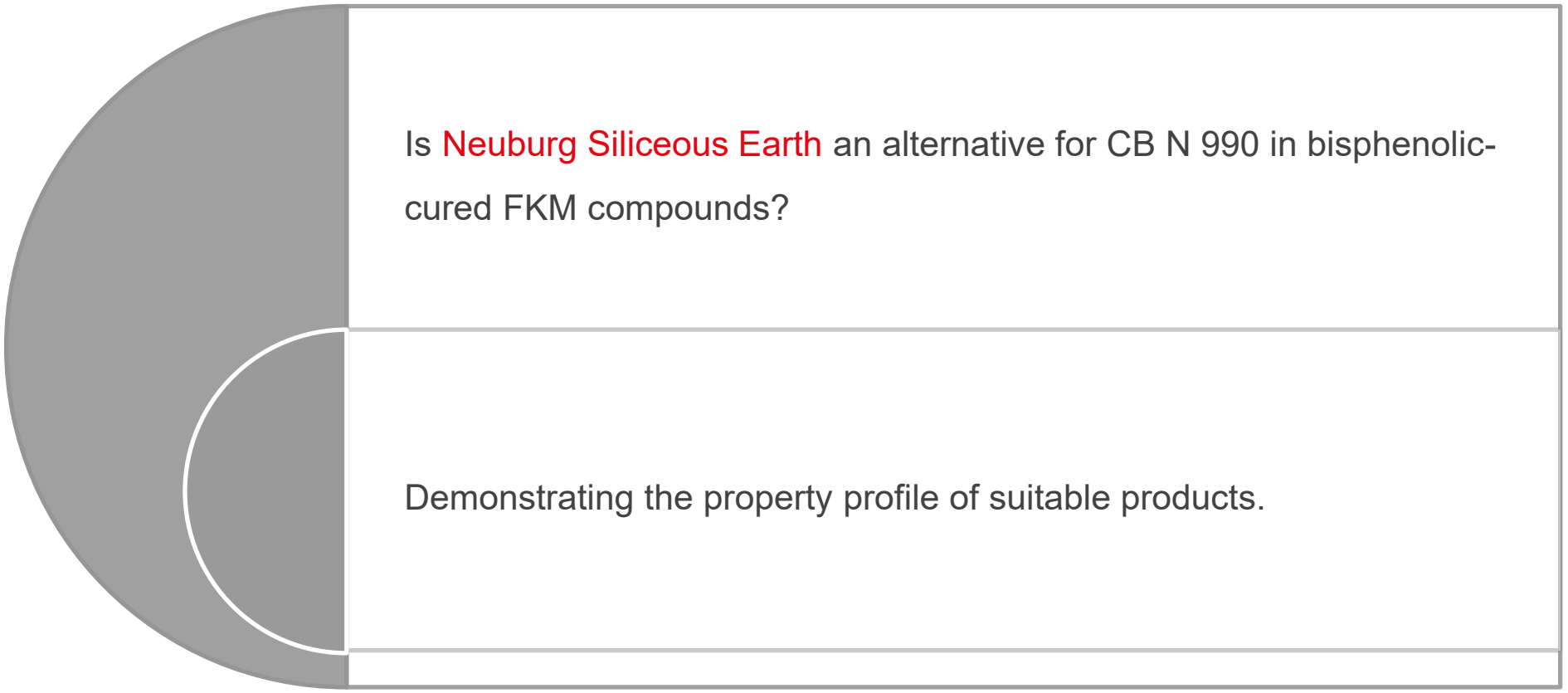
Status quo


Wollastonite
Barium sulfate
traditionally used fillers
in FKM compounds
Carbon black
N 990

Objective


Is Neuburg Siliceous Earth an alternative for CB N 990 in bisphenolic-cured FKM compounds?
Demonstrating the property profile of suitable products.

Formulation

in phr		N 990	NSE
Viton A-201C	FKM, ML 1+10 (121 °C): 20 MU high curative level	100	100
Elastomag 170	MgO	3	3
Vulcofac F45	$Ca(OH)_2$	6	6
N 990	Carbon black	30	-
NSE	Neuburg Siliceous Earth	-	45

Fillers and characteristics

Filler	Description	Functionalization
N 990	Carbon black MT	-
Sillitin V 85	Neuburg Siliceous Earth, d_{50}: 5.0 µm	-
Aktisil Q	Neuburg Siliceous Earth, d_{50}: 5.0 µm	Methacryl
Aktisil AM	Neuburg Siliceous Earth, d_{50}: 2.4 µm	Amino

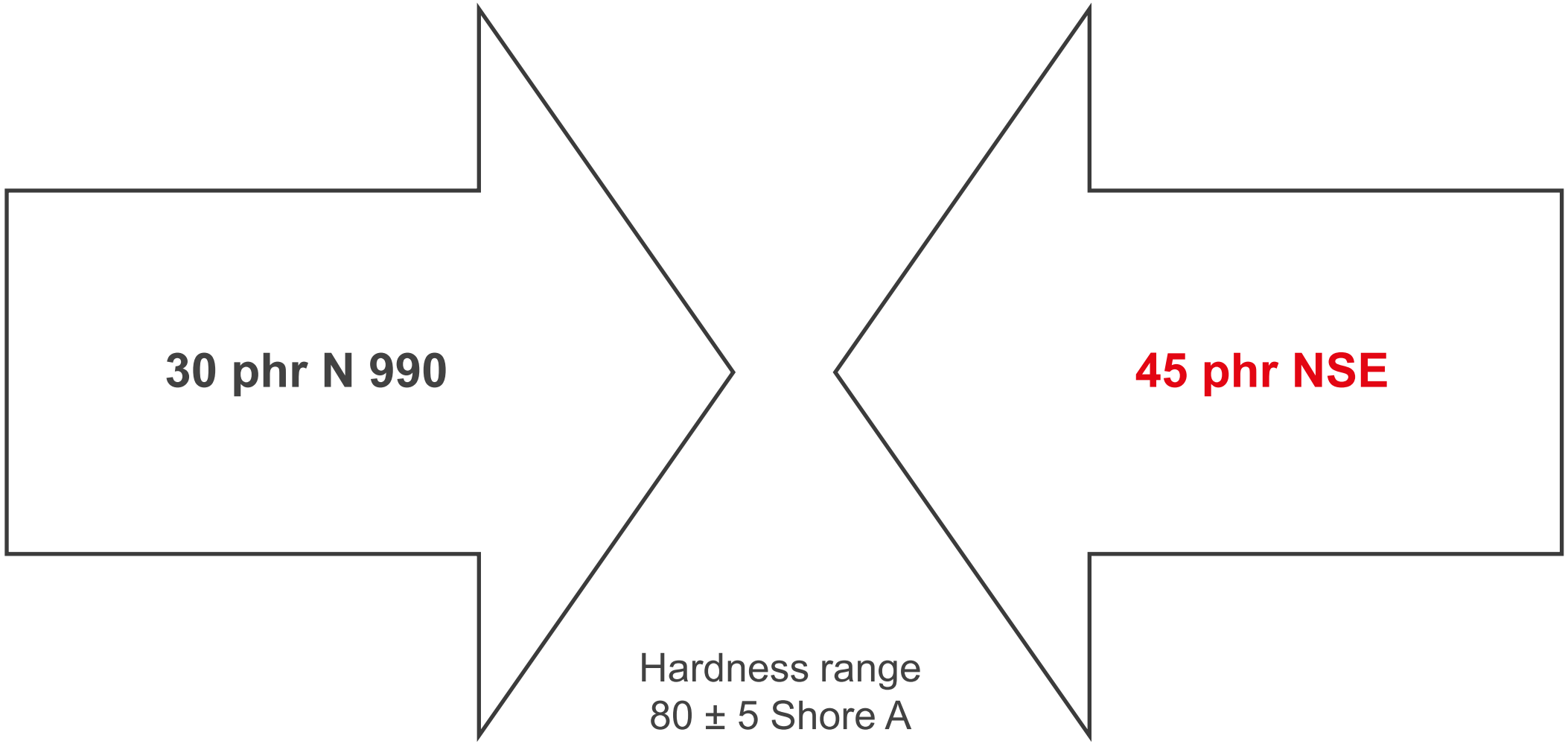
Compound preparation and curing

Mixing	
Open mill	Ø 150 x 300 mm
Batch weight	approx. 1 kg
Temperature	50 °C 30 °C for removing the sheet off the mill
Mixing time	approx. 15 min.
Curing and post-cure	
Cure	7 min. / 177 °C
Post-cure	2 h / 232 °C
All values shown refer to post-cured specimens unless otherwise noted.	

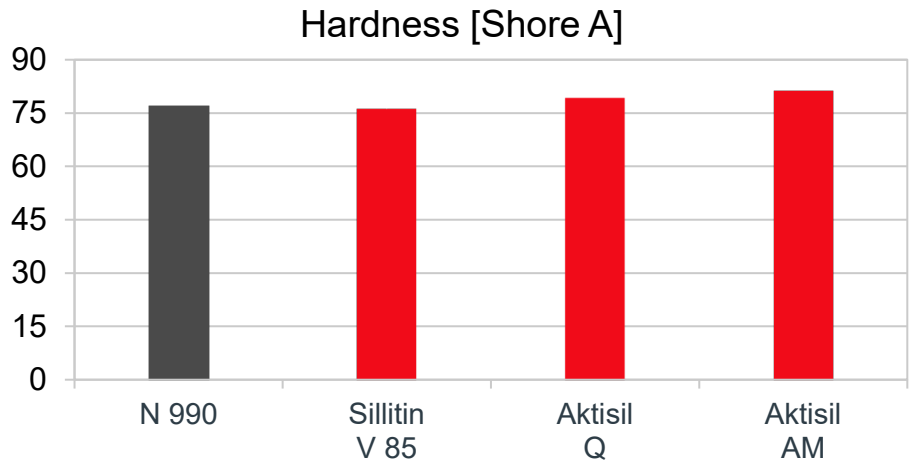
Tests

PrüfungTest	Standard	Conditions
Mooney Viscosity ML 1+4	DIN 53 523, Part 3	100 °C
Curemeter testing	DIN 53 529, Part 1 – 4	177 °C, 0.2 ° deflection
Tensile test	DIN 53 504, S2	
Compression set	DIN ISO 815-1, Type B	70 h / 232 °C / 25 % defl.
Tear resistance	DIN ISO 34-1, A	
Storage in hot air	DIN 53 508	70 h / 232 °C
Immersion in liquid media	DIN ISO 1817	Dest. water, 168 h / 60 °C Fuel FAM B, 70 / 23 °C Oil OS206304, 168 h / 150 °C

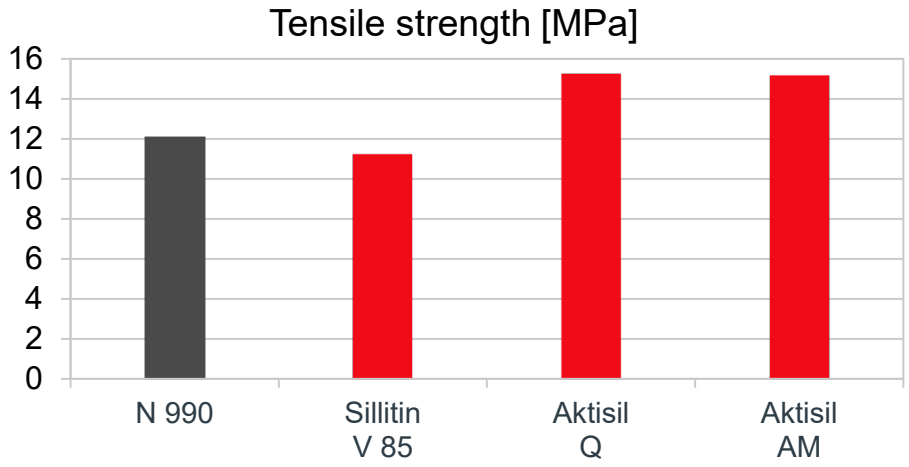
Neuburg Siliceous Earth vs. N 990

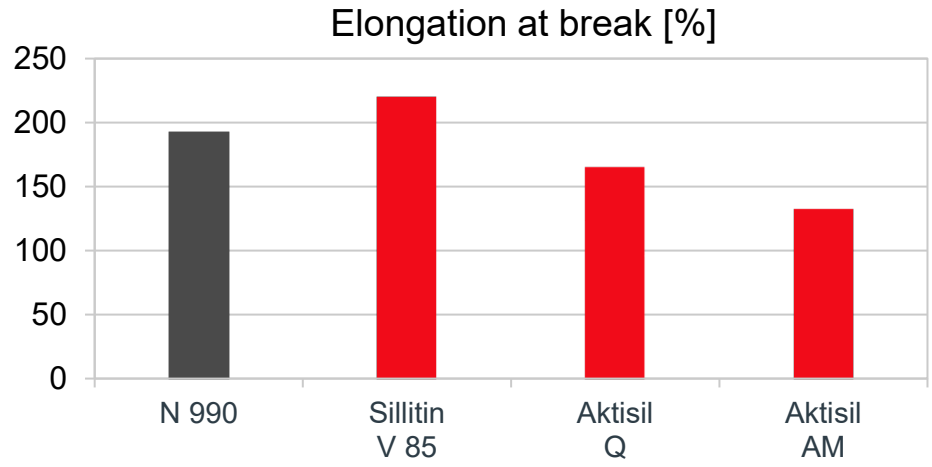


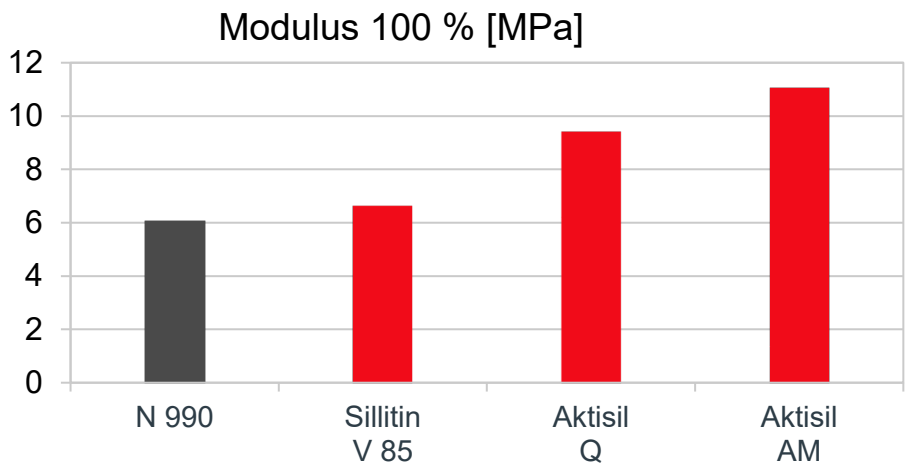
Hardness

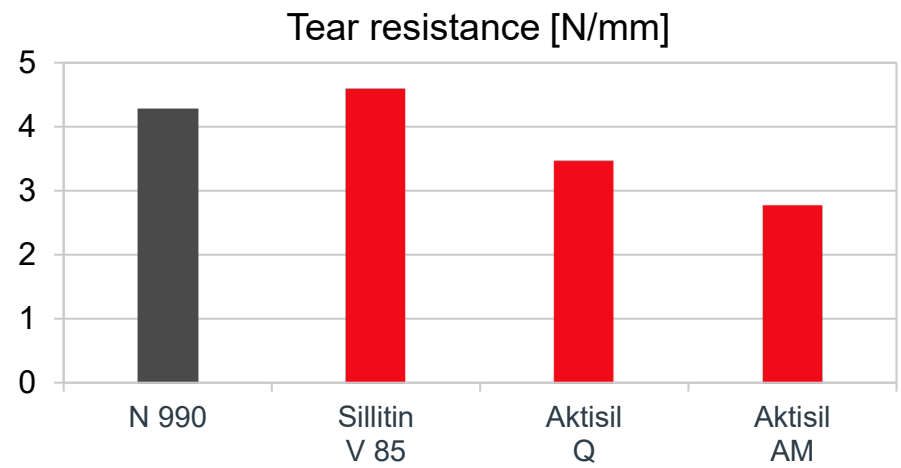

Hardness [Shore A]
90
75
60
45
30
15
0
N 990
Sillitin V 85
Aktisil Q
Aktisil AM

Tensile tests

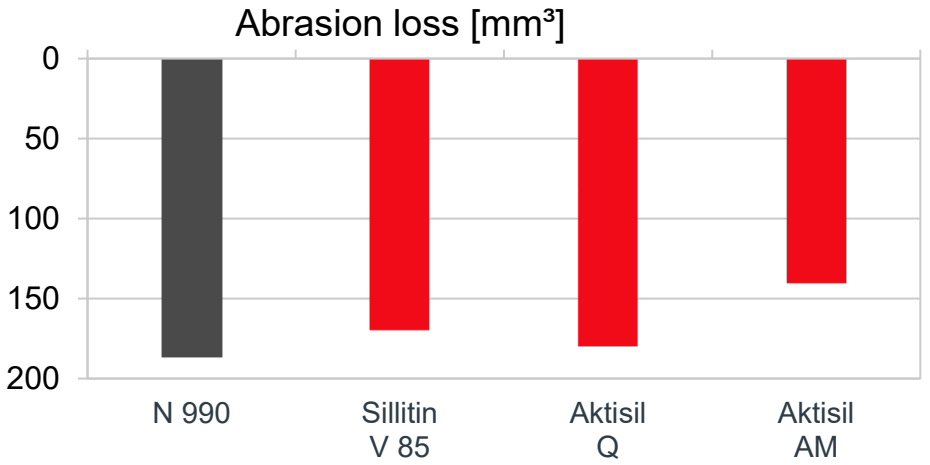


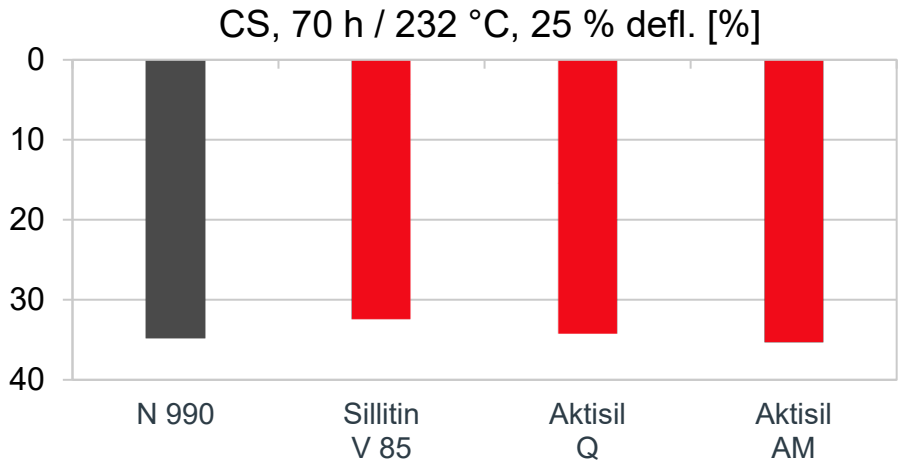




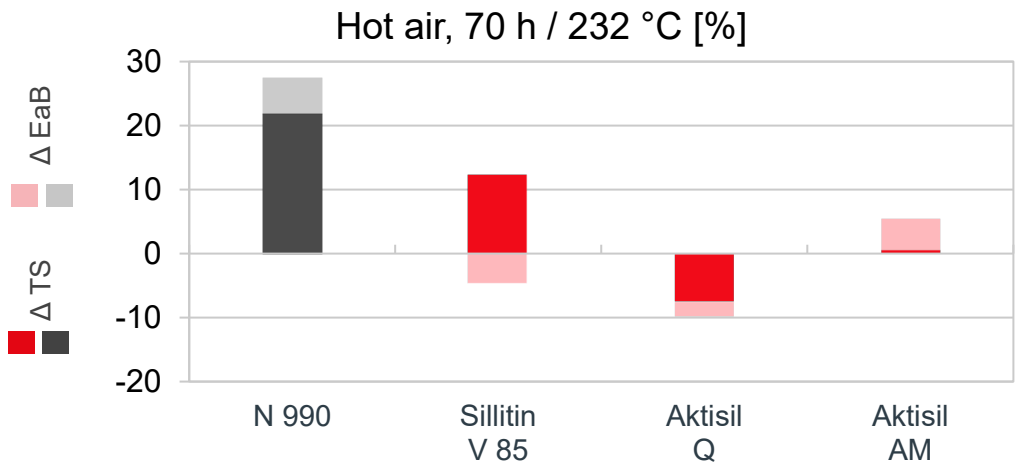


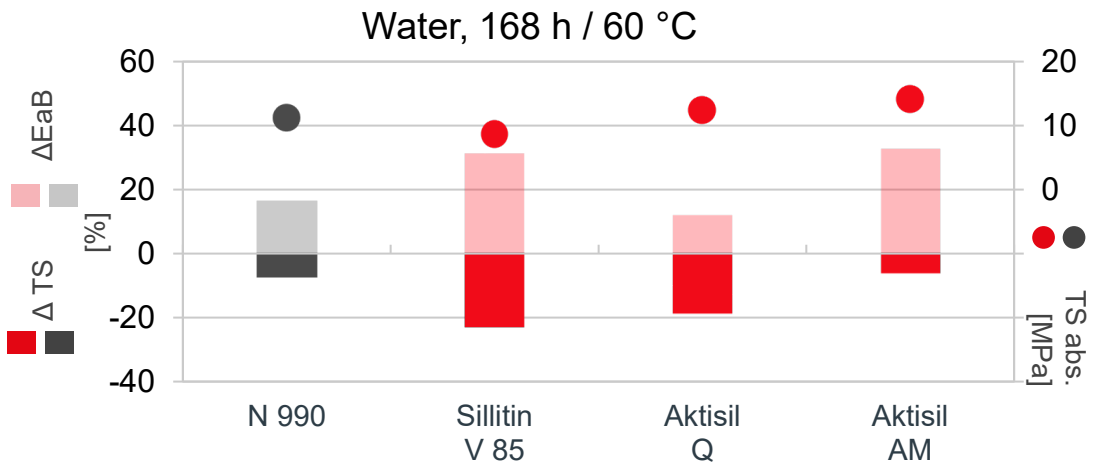
Abrasion resistance and compression set

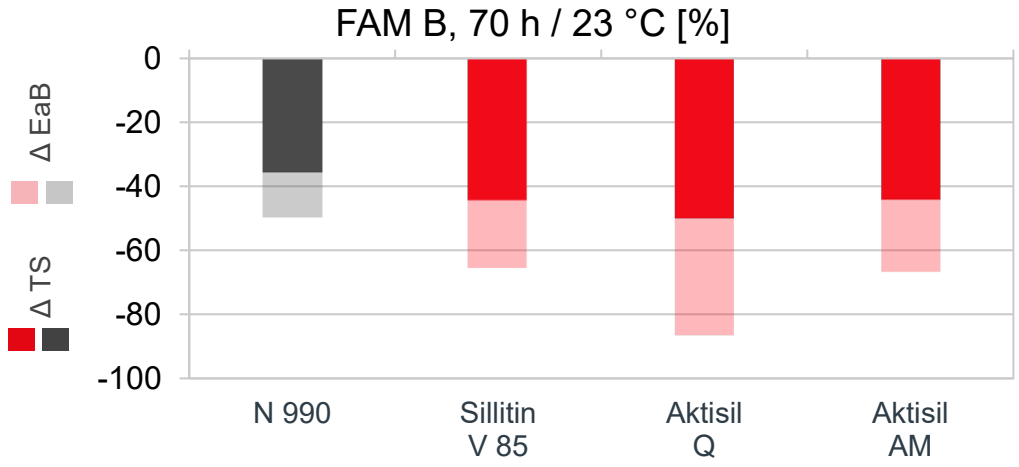


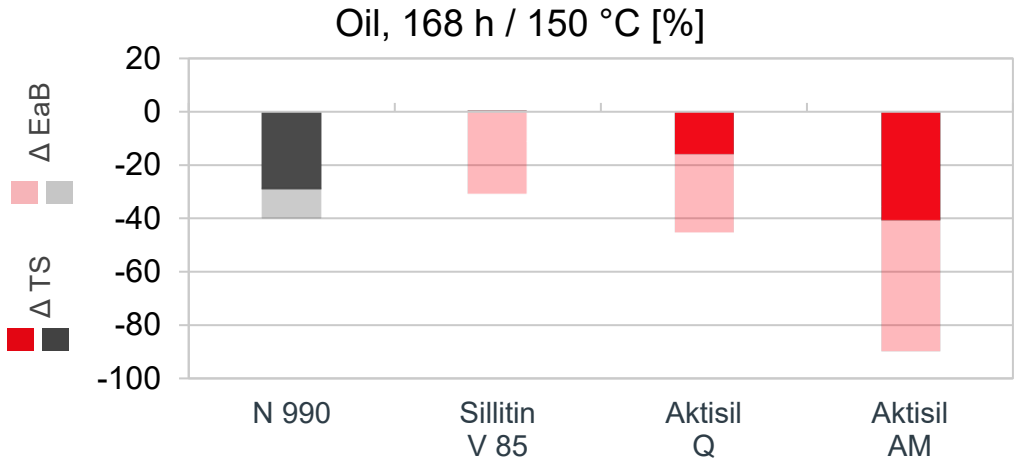


Resistance to hot air, water, fuel and oil



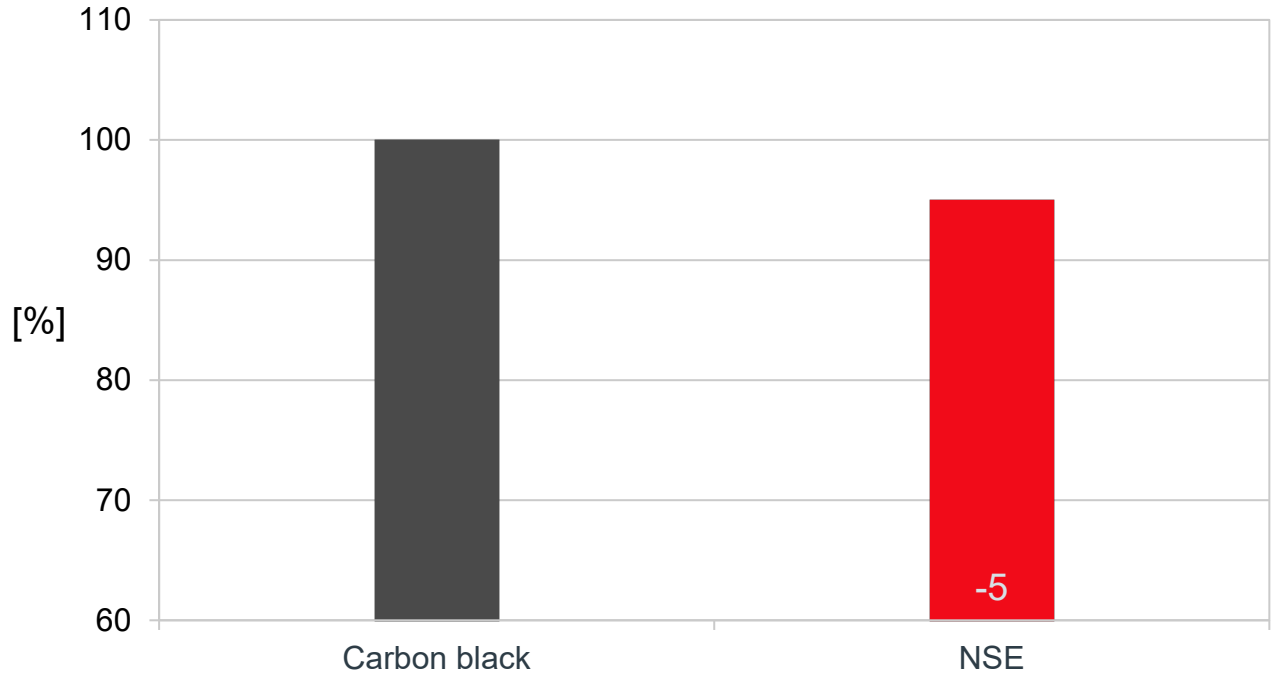






An additional benefit…

Reduction of CO_2 eq. after replacing CB with NSE, volume based



NSE vs. N 990

75 – 85 Shore A	Sillitin V 85	Aktisil Q	Aktisil AM
Tensile strength	=	+	+
Elongation at break	+	=	
Modulus 100 %		+	+
Tear resistance	=		
Abrasion resistance	=	=	+
CS ISO 232 °C	=	=	=
Resistance to hot air	+	+	+
Resistanct to water		=	=
Resistance to fuel	=		=
Resistance to oil	=	=	

We supply materials for good ideas!

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Results in tabular form

		N 990	Sillitin V 85	Aktisil Q	Aktisil AM
Rheology					
Mooney viscosity, ML 1+4, 100 °C	MU	71	104	96	99
Rotorless Curemeter, M_{min}, 177 °C	Nm	0.03	0.05	0.04	0.06
Rotorless Curemeter, V_{max}, 177 °C	Nm/min.	2.2	0.6	1.4	0.8
Rotorless Curemeter, t_{90}, 177 °C	min.	2.1	5.0	3.1	3.7
Mechanical properties (cured 10 min. / 177 °C, no post-cure)					
Hardness	Shore A	74	74	77	78
Tensile strength	MPa	9.5	8.9	10	14
Elongation at break	%	272	303	235	151
Modulus 50 %	MPa	2.5	2.7	3.5	4.2
Modulus 100 %	MPa	4.0	4.4	6.2	9.3
Tear resistance	N/mm	4.4	4.5	3.9	2.7
CS ISO 70 h / 232 °C / 25 %	%	66	71	80	60
Abrasion loss	mm^3	257	250	230	145

Results in tabular form

		N 990	Sillitin V 85	Aktisil Q	Aktisil AM
Mechanical properties (cured 10 min. / 177 °C, post-cure 24 h / 232 °C)					
Hardness	Shore A	77	76	79	81
Tensile strength	MPa	12	11	15	15
Elongation at break	%	192	220	165	133
Modulus 50 %	MPa	3.3	3.4	4.5	4.8
Modulus 100 %	MPa	6.0	6.6	9.4	11
Tear resistance	N/mm	4.3	4.6	3.5	2.8
CS ISO 70 h / 232 °C / 25 %	%	35	32	34	35
Abrasion loss	mm^3	186	170	180	140

Results in tabular form

		N 990	Sillitin V 85	Aktisil Q	Aktisil AM
Storage in hot air, 70 h / 232 °C					
Hardness	Shore A	80	78	79	81
Tensile strength	MPa	15	13	14	15
Elongation at break	%	203	210	162	139
Δ Hardness	Shore A	+3	+2	0	0
Δ Tensile strength	%	+22	+12	-7.4	+0.5
Δ Elongation at break	rel.%	+5.6	-4.5	-2.3	+4.9

Results in tabular form

		N 990	Sillitin V 85	Aktisil Q	Aktisil AM
Storage in water, 168 h / 60 °C					
Hardness	Shore A	79	76	79	79
Tensile strength	MPa	11	8,7	12	14
Elongation at break	%	224	288	185	176
Δ Hardness	Shore A	+2	0	0	-2
Δ Tensile strength	%	-7.3	-23	-19	-6,4
Δ Elongation at break	rel.%	+16	+31	+12	+33
Δ Weight	%	+0.4	+0.9	+0.7	+0.9
Δ Volume	%	+0.2	+0.9	+0.5	+1.1

Results in tabular form

		N 990	Sillitin V 85	Aktisil Q	Aktisil AM
Storage in fuel, 70 h / 23 °C					
Hardness	Shore A	65	63	68	67
Tensile strength	MPa	7.8	6.3	7.6	8.5
Elongation at break	%	165	173	105	103
Δ Hardness	Shore A	-12	-13	-11	-14
Δ Tensile strength	%	-35	-44	-50	-44
Δ Elongation at break	rel.%	-14	-21	-37	-23
Δ Weight	%	+7.5	+7.2	+7.7	+7.9
Δ Volume	%	+17	+18	+19	+19

Results in tabular form

		N 990	Sillitin V 85	Aktisil Q	Aktisil AM
Storage in oil, 168 h / 150 °C					
Hardness	Shore A	75	76	80	80
Tensile strength	MPa	8.6	11	13	9.0
Elongation at break	%	171	152	117	68
Δ Hardness	Shore A	-2	0	+1	-1
Δ Tensile strength	%	-29	+0.2	-16	-41
Δ Elongation at break	rel.%	-11	-31	-29	-49
Δ Weight	%	+0.6	+0.6	+0.7	+0.7
Δ Volume	%	+1.0	+0.6	+0.6	+0.9