Tailored Filler Solutions

Struktosil 45 MAM – small effort, big impact

EPDM, peroxide cured

Author: Michael Aufmuth

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Struktosil 45 MAM

We will use our know-how of Neuburg Siliceous Earth and transfer it to new base materials, combined with innovative modifications for further improvement.

Formulation

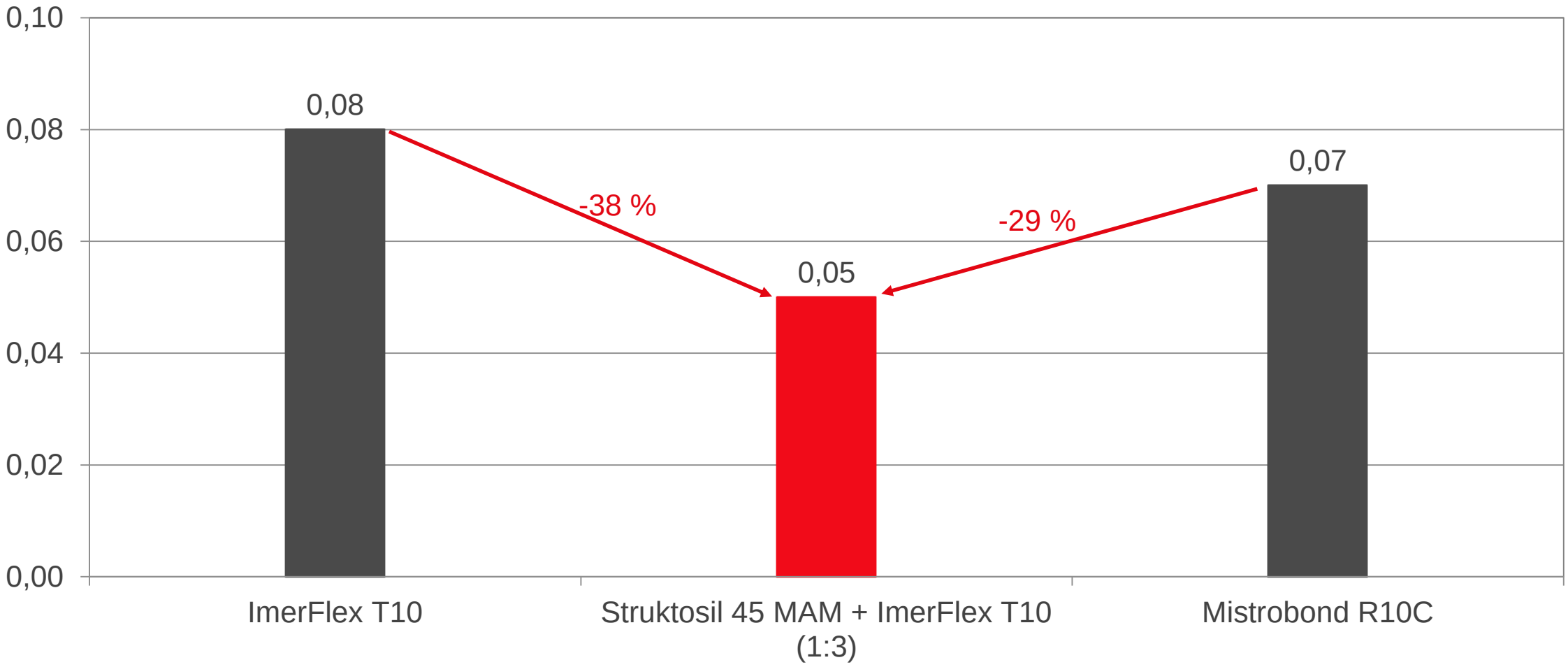
Material	Description	phr		
Keltan 2650	Ethylene propylene diene rubber, amorphous, ML 1+4 (125 °C): 25 MU	100		
Zinkoxyd aktiv	Zinc oxide	3		
Edenor C18 98-100 GW	Stearic acid	0.5		
ImerFlex T10	Talc, non-treated	120	90	
Struktosil 45 MAM	Talc, surface treated		30	
Mistrobond R10C	Talc, surface treated			120
Process Oil P460	Paraffinic mineral oil, plasticizer	5		
Vulkanox HS/LG	Antioxidant, TMQ	0.7		
Vulkanox ZMB2/C-5	Antioxidant, ZMMBI	0.7		
PEG 4000	Polyethylene glycol	1		
TAC GR 70	Triallylcyanurate, 70 %, coagent	0.4		
Perkadox 14-40B-pd-s	Di(tert-butylperoxyisopropyl)benzene, 40 %, peroxide	3.5		
Total		**234.8**		

Fillers & characteristics

	Particle size		Oil absorption	Sieve residue > 40 µm	Density	Specific surface area BET	Color CIELAB scale Lightness L*	Surface treatment
	D_{50} [µm]	D_{97} [µm]	[g/100g]	[mg/kg]	[g/cm³]	[m²/g]		
ImerFlex T10	3.7	11.8	49	2	2.85	13	95	none
Struktosil 45 MAM	4.0	11.0	55	7	2.85	9	98	Methacrylic silane
Mistrobond R10C	4.6	16.3	46	28	2.85	9	94	Amino silane

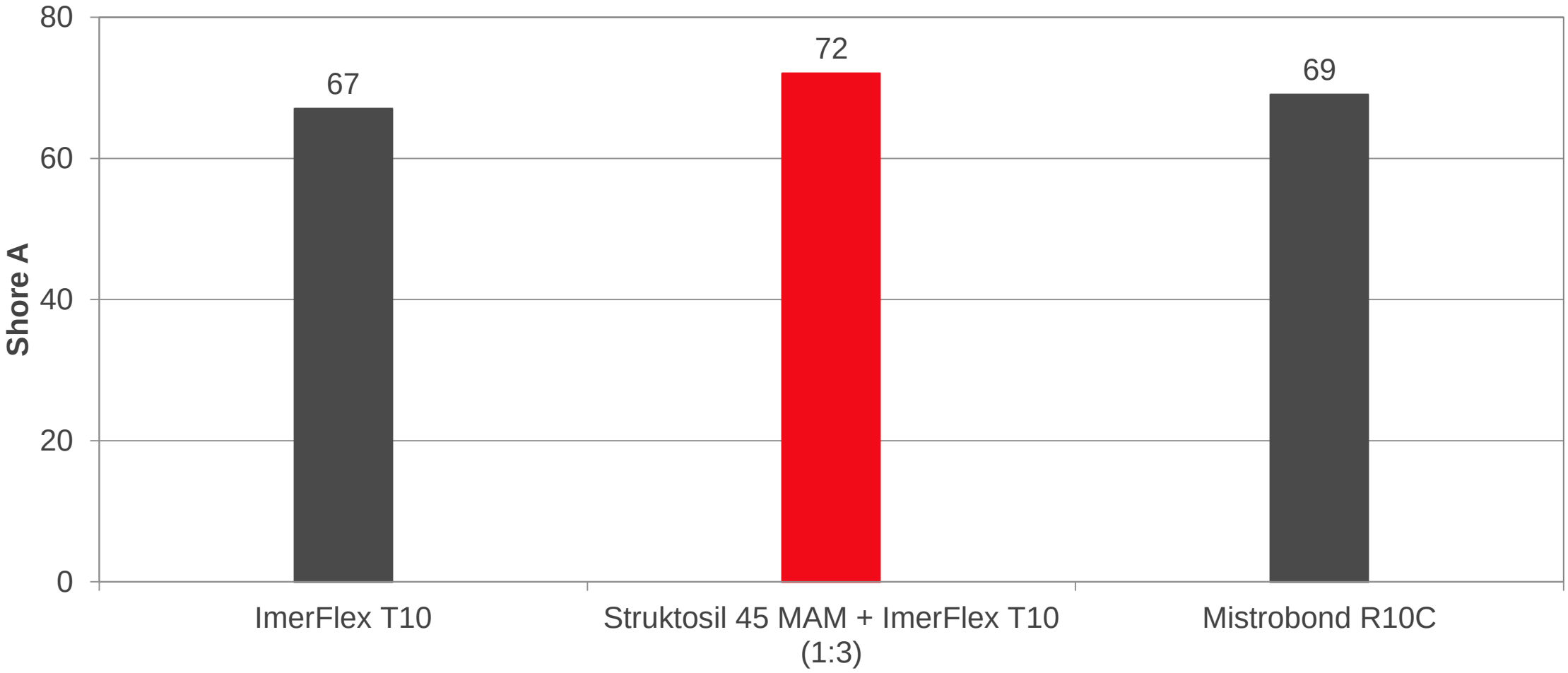
Rotorless curemeter
tan δ, 180 °C, end of test

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



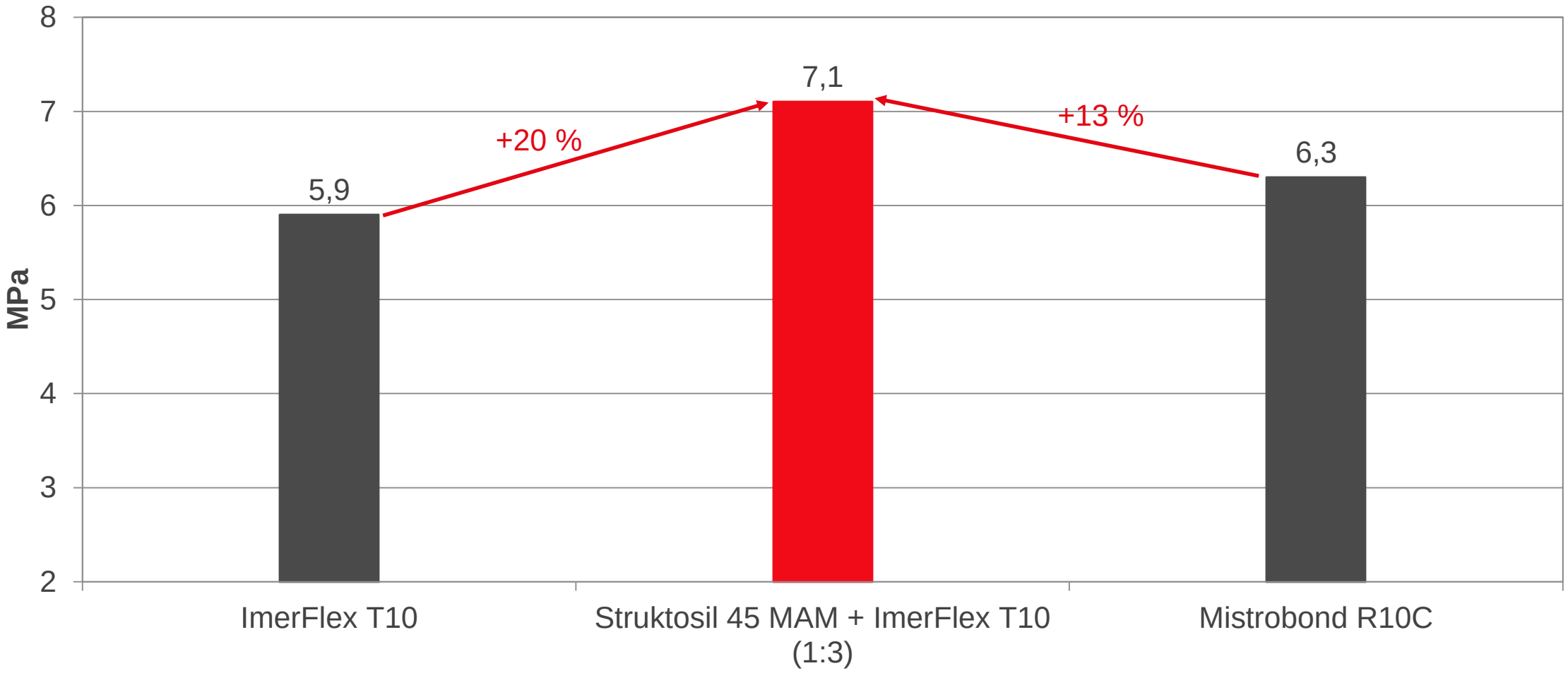
Hardness

DIN 53 505-A, piled-up S2 dumbbells



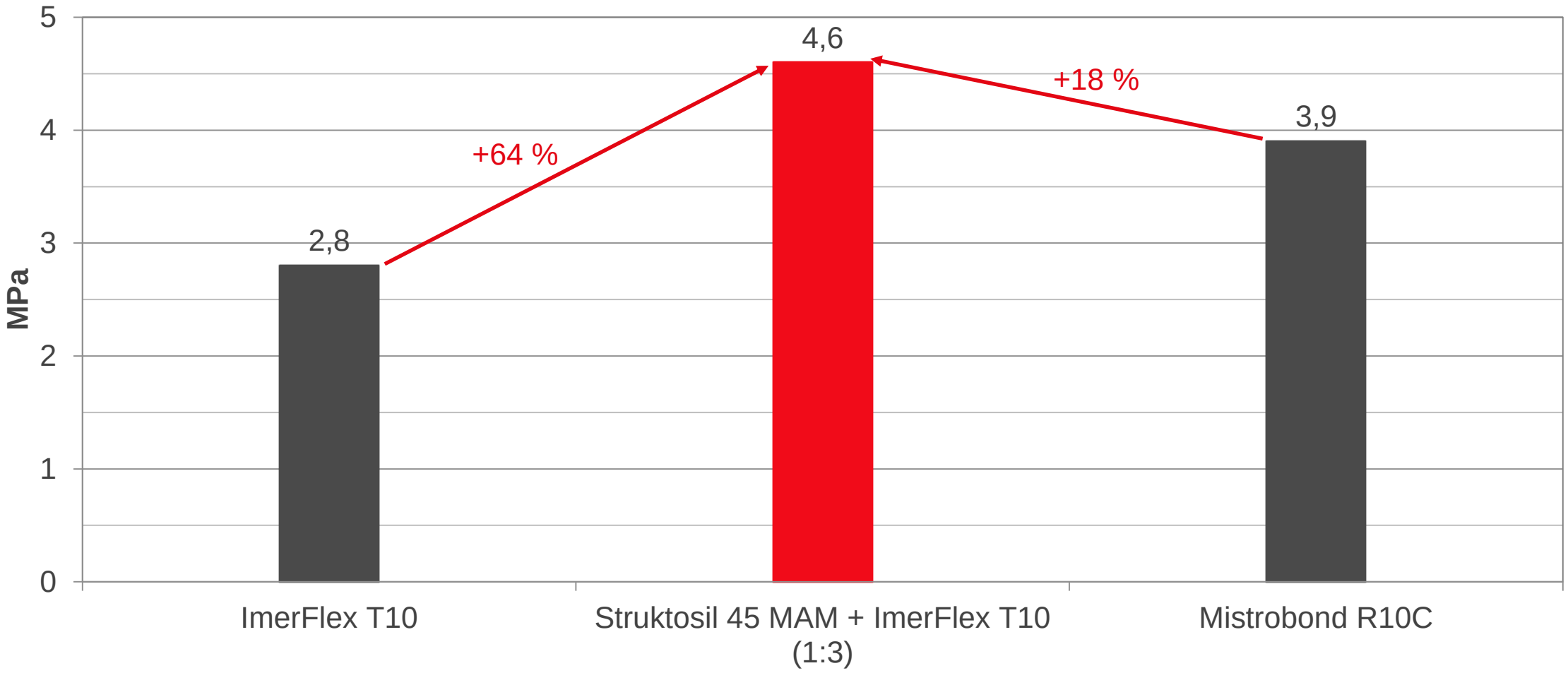
Tensile strength

DIN 53 504, S2



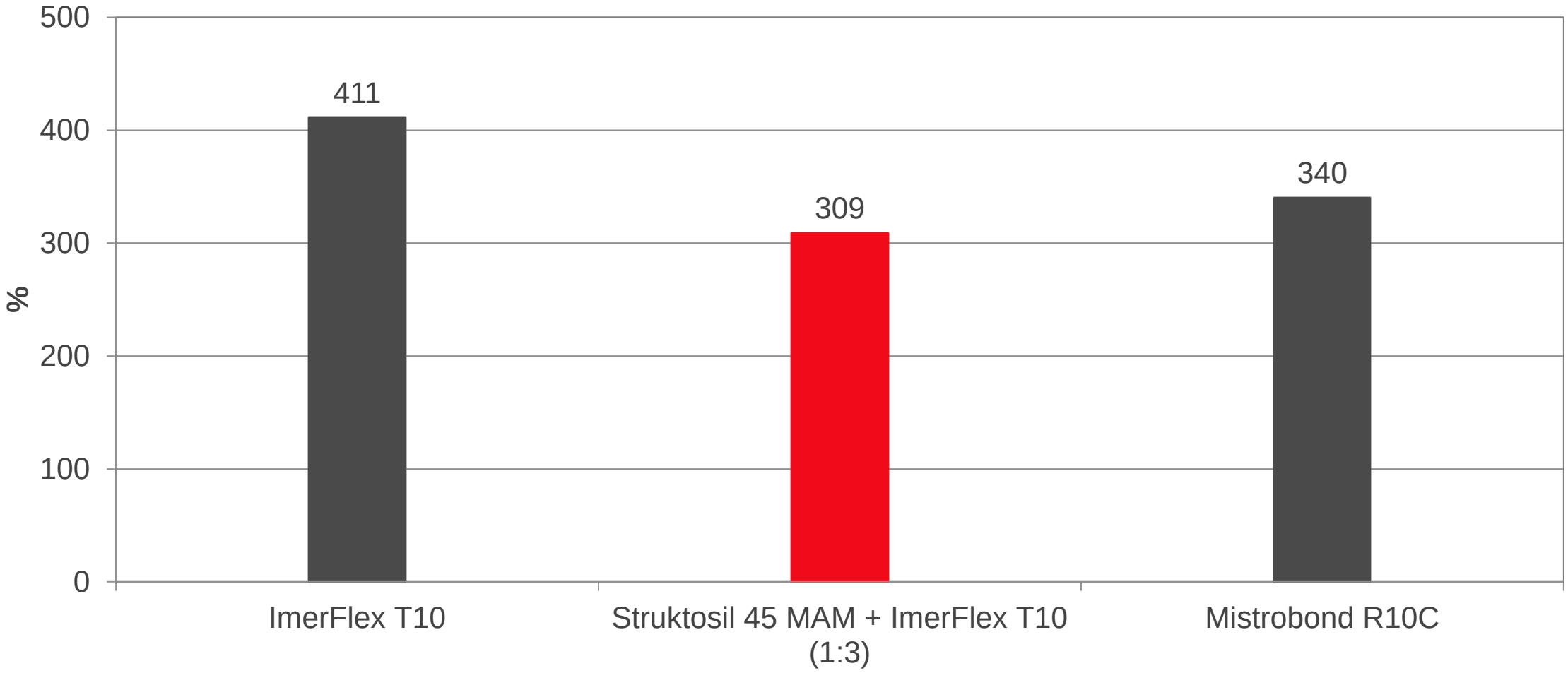
Modulus 100 %

DIN 53 504, S2



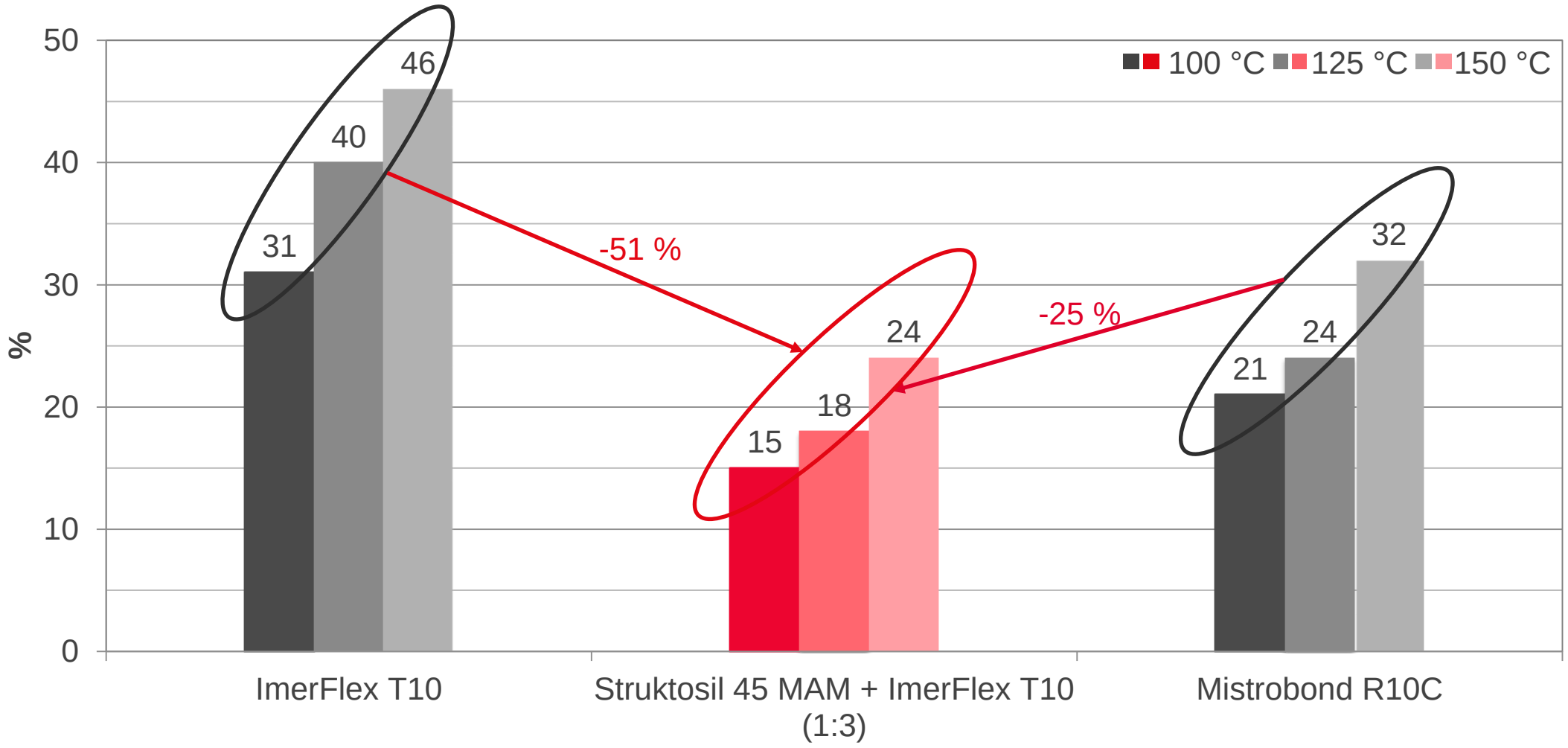
Elongation at break

DIN 53 504, S2



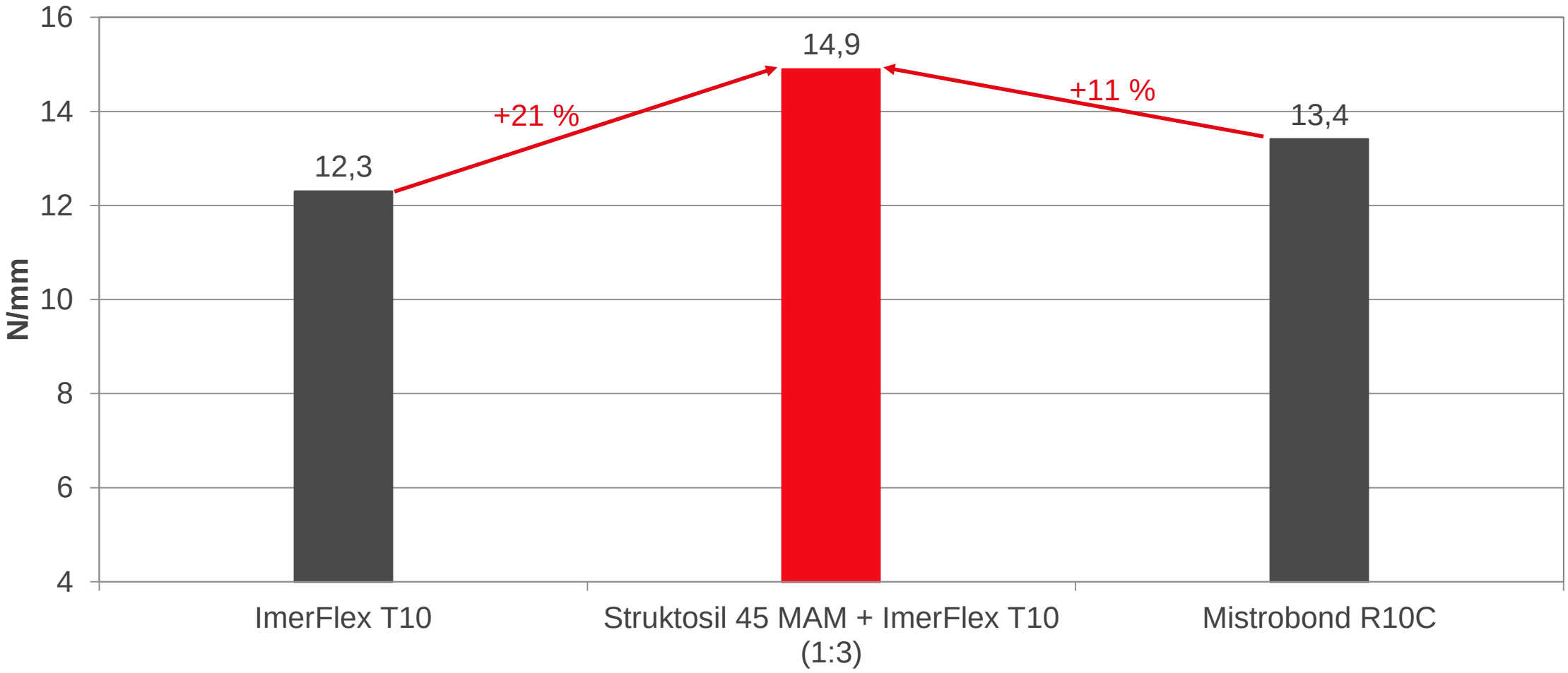
Compression set

DIN ISO 815-1 B, 24 h, 25 % defl.



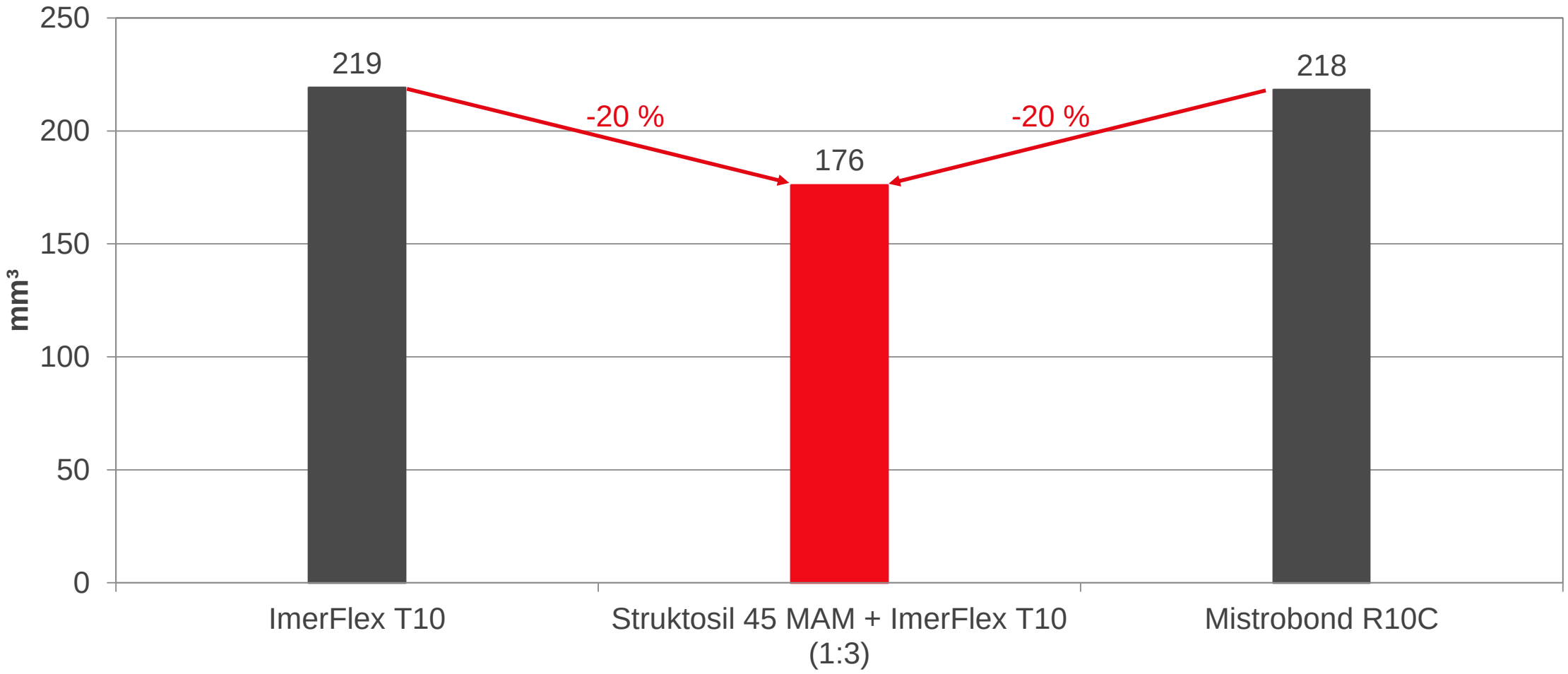
Tear resistance

DIN ISO 34-1Bb, Graves specimen



Abrasion loss

DIN ISO 4649, 10 N

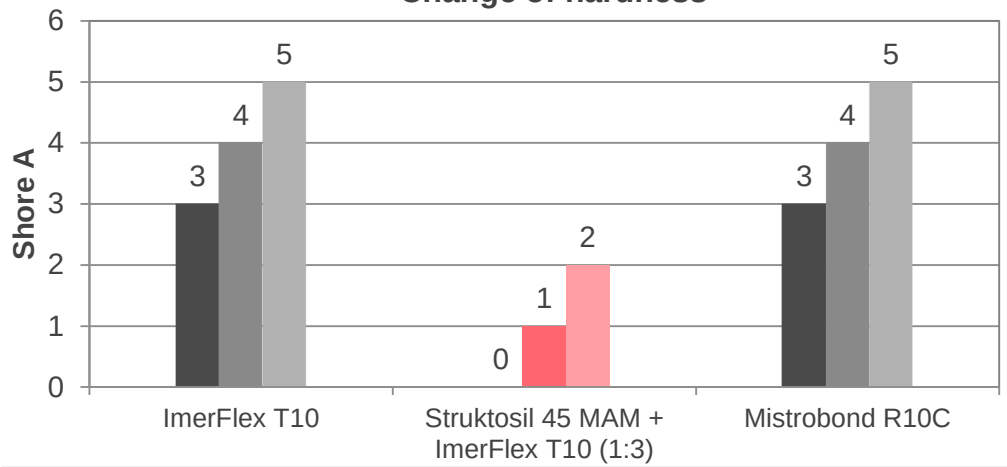


Aging in hot air

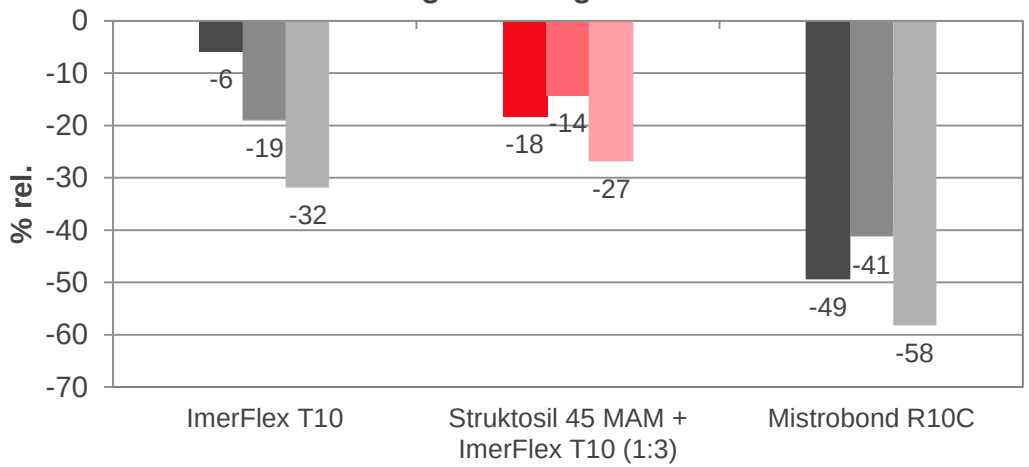
168 h

100 °C 125 °C 150 °C

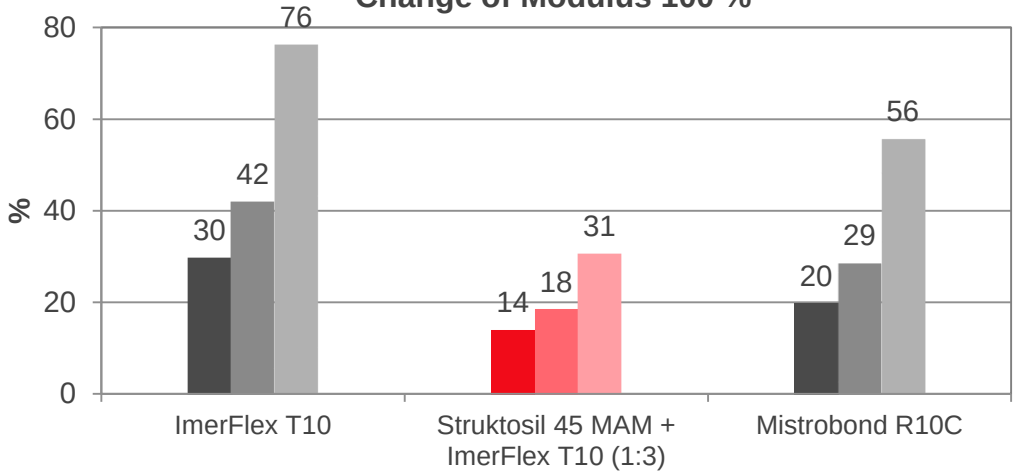
Change of hardness



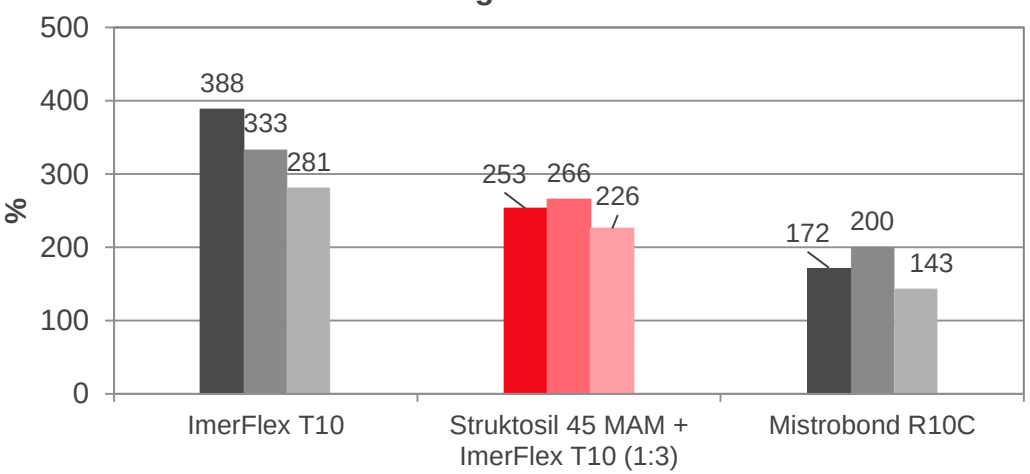
Change of elongation at break



Change of Modulus 100 %

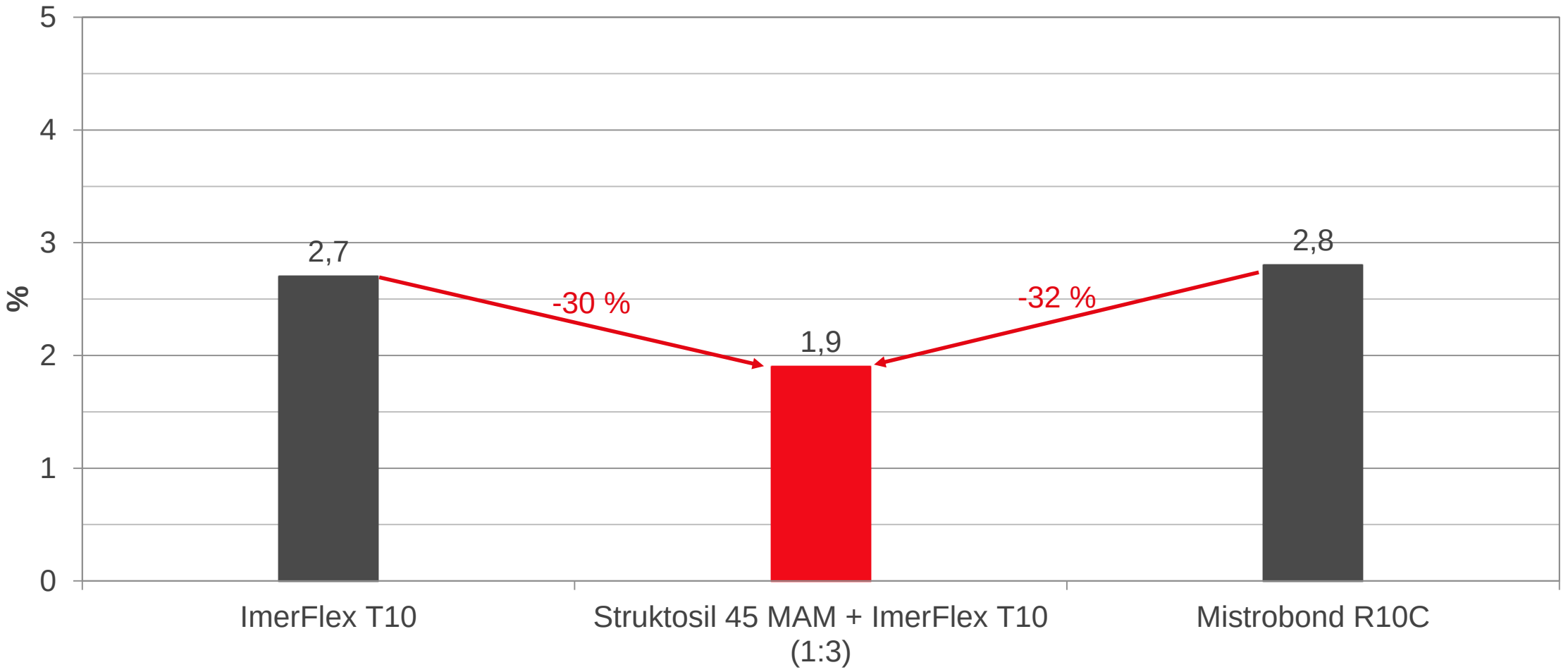


Elongation at break



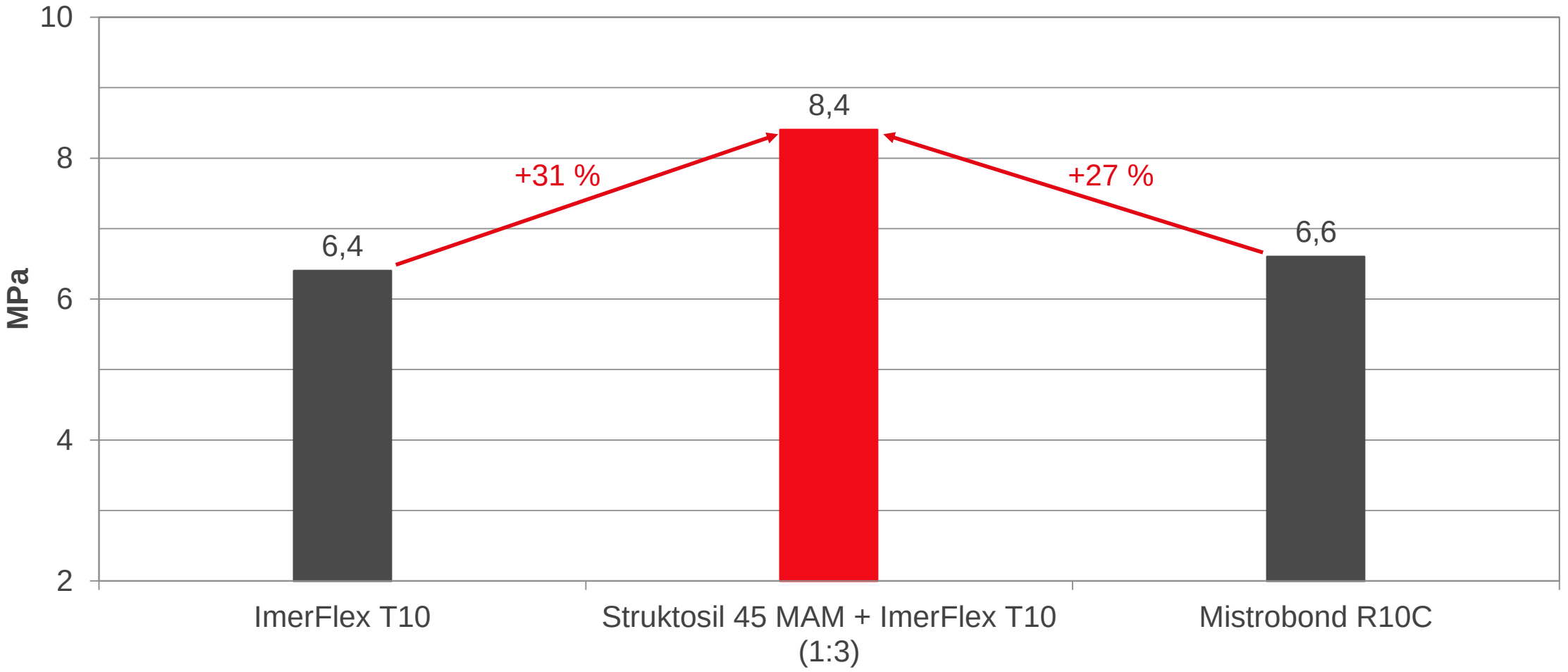
Storage in deionised water
Change of weight

168 h / 95 °C



Storage in deionised water
Tensile strength

168 h / 95 °C



Conclusion

Advantages of 25 % Struktosil 45 MAM in blend with 75% ImerFlex T10 compared to ImerFlex T10:

- Lower tangent delta at the end of vulcanization
- Strongly increased moduli
- Higher tensile strength
- Strongly reduced compression set
- Slightly increased tear resistance (Graves)
- Improved abrasion resistance
- Better hot air resistance
- Better hot water resistance

Advantages of 25 % Struktosil 45 MAM in blend with 75 % ImerFlex T10 compared to Mistrobond R10C:

- Lower tangent delta at the end of vulcanization
- Higher moduli
- Slightly higher tensile strength
- Significantly lower compression set
- Slightly higher tear resistance (Graves)
- Improved abrasion resistance
- Better hot air resistance
- Better hot water resistance

We supply material for good ideas!

HOFFMANN MINERAL GmbH
Muenchener Straße 75
DE-86633 Neuburg (Donau)

Phone: +49 8431 53-0
Internet: www.hoffmann-mineral.com
E-mail: info@hoffmann-mineral.com

Preparation and curing of the compound

Mixing	
Open mill	Ø 150 x 300 mm
Batch amount	approx. 800 g
Temparature	50 °C
Mixing time	approx. 13 min

Curing	
Press temparature	180 °C
Curing time	t_{90} + 10 % 6.0 min – 6.5 min

Results in tabular form
Rheology

		ImerFlex T10	Struktosil 45 MAM + Talc 1 (1:3)	Mistrobond R10C
Mooney viscosity, ML 1+4, 100 °C	MU	47	46	48
Mooney viscosity, ML 1+4, 120 °C	MU	36	34	36
Mooney scorch time, ML +5, 120 °C	min	86	70	74
Rotorless curemeter, M_{min}, 180 °C	Nm	0.06	0.06	0.06
Rotorless curemeter, M_{max}, 180 °C	Nm	0.96	0.99	0.95
Rotorless curemeter, $M_{max-min}$, 180 °C	Nm	0.90	0.94	0.89
Rotorless curemeter, V_{max}, 180 °C	Nm / min	0.36	0.4	0.37
Rotorless curemeter, t_5, 180 °C	min	0.49	0.49	0.51
Rotorless curemeter, t_{10}, 180 °C	min	0.64	0.63	0.64
Rotorless curemeter, t_{90}, 180 °C	min	5.83	5.57	5.46
Curing time	min	6.41	6.13	6.01
Rotorless curemeter, tan delta, 180 °C		0.08	0.05	0.07

Results in tabular form
Mechanical properties

		ImerFlex T10	Struktosil 45 MAM + ImerFlex T10 (1:3)	Mistrobond R10C
Hardness	Shore A	67	72	69
Tensile strength	MPa	5.9	7.1	6.3
Modulus 50 %	MPa	2.4	3.4	2.9
Modulus 100 %	MPa	2.8	4.6	3.9
Modulus 200 %	MPa	3.2	5.4	4.6
Modulus 300 %	MPa	3.9	6.9	5.3
Elongation at break	%	411	309	340
Tear resistance (Graves)	N / mm	12.3	14.9	13.4
Tear resistance (Trousers)	N / mm	4.7	4.3	4.4
Rebound elasticity	%	50	n. d.	51
Abrasion loss	mm^3	219	176	218
Compression set, 24 h / 100 °C, 25 % defl.	%	31	15	21
Compression set, 24 h / 125 °C, 25 % defl.	%	40	18	24
Compression set, 24 h / 150 °C, 25 % defl.	%	46	24	32

Results in tabular form
Color CIELAB scale

	ImerFlex T10	Struktosil 45 MAM + ImerFlex T10 (1:3)	Mistrobond R10C
L*	75.9	77.2	77.0
a*	0.2	0.5	-0.6
b*	12.8	12.4	14.8

Results in tabular form
Aging in hot air, 168 h / 100 °C

Absolute Value					Relative change based on the mechanics before storage				
		ImerFlex T10	**Blend**	**Mistrobond R10C**			**ImerFlex T10**	**Blend**	**Mistrobond R10C**
Hardness	Shore A	70	72	72	Δ	Shore A	3	0	3
Tensile strength	MPa	6.2	7.0	5.3	Δ	%	5.6	-2.1	-15.6
Modulus 50 %	MPa	3.0	3.9	3.3	Δ	%	23.8	12.2	15.7
Modulus 100 %	MPa	3.7	5.3	4.7	Δ	%	29.6	13.9	19.7
Modulus 200 %	MPa	4.2	6.2	n. d.	Δ	%	29.5	13.1	n. d.
Modulus 300 %	MPa	4.9	n. d.	n. d.	Δ	%	25.9	n. d.	n. d.
Elongation at break	%	388	253	172	Δ	%	-5.8	-18.1	-49.4
Tear resistance (Graves)	N / mm	13.0	15.1	15.2	Δ	%	5.4	1.3	13.0
Tear resistance (Trousers)	N / mm	4.2	4.4	4.5	Δ	%	-11.9	2.8	2.5
Rebound elasticity	%	52	n. d.	54	Δ	%	4.0	n. d.	5.9

Results in tabular form
Aging in hot air, 168 h / 125 °C

Absolute Value					Relative change based on the mechanics before storage				
		ImerFlex T10	Blend	Mistrobond R10C			ImerFlex T10	Blend	Mistrobond R10C
Hardness	Shore A	71	73	73	Δ	Shore A	4	1	4
Tensile strength	MPa	5.7	7.7	6.0	Δ	%	-2.9	8.6	-5.6
Modulus 50 %	MPa	3.1	3.9	3.5	Δ	%	31.4	14.9	23.1
Modulus 100 %	MPa	4.0	5.5	5.0	Δ	%	41.9	18.4	28.5
Modulus 200 %	MPa	4.6	6.4	6.0	Δ	%	43.2	18.0	30.2
Modulus 300 %	MPa	5.2	n. d.	n. d.	Δ	%	35.5	n. d.	n. d.
Elongation at break	%	333	266	200	Δ	%	-19.0	-14.1	-41.2
Tear resistance (Graves)	N / mm	14.1	15.4	14.8	Δ	%	14.5	3.7	10.5
Tear resistance (Trousers)	N / mm	4.2	4.5	4.4	Δ	%	-11.0	5.1	-1.1
Rebound elasticity	%	55	n. d.	56	Δ	%	10.0	n. d.	9.8

Results in tabular form
Aging in hot air, 168 h / 150 °C

Absolute Value					Relative change based on the mechanics before storage				
		ImerFlex T10	Blend	Mistrobond R10C			ImerFlex T10	Blend	Mistrobond R10C
Hardness	Shore A	72	74	74	Δ	Shore A	5	2	5
Tensile strength	MPa	6.4	7.7	6.9	Δ	%	9.7	7.6	9.7
Modulus 50 %	MPa	3.7	4.3	4.0	Δ	%	56.5	25.1	39.5
Modulus 100 %	MPa	5.0	6.0	6.1	Δ	%	76.1	30.5	55.6
Modulus 200 %	MPa	5.8	7.1	n. d.	Δ	%	80.7	30.7	n. d.
Modulus 300 %	MPa	n. d.	n. d.	n. d.	Δ	%	n. d.	n. d.	n. d.
Elongation at break	%	281	226	143	Δ	%	-31.8	-26.8	-58.1
Tear resistance (Graves)	N / mm	14.8	15.5	15.7	Δ	%	20.0	3.9	16.9
Tear resistance (Trousers)	N / mm	4.2	4.2	3.9	Δ	%	-11.2	-3.5	-11.6
Rebound elasticity	%	55	n. d.	57	Δ	%	10.0	n. d.	11.8

Results in tabular form
Storage in deionised water, 168 h / 95 °C

Absolute Value					Relative change based on the mechanics before storage				
		ImerFlex T10	**Blend**	**Mistrobond R10C**			**ImerFlex T10**	**Blend**	**Mistrobond R10C**
Hardness	Shore A	66	70	69	Δ	Shore A	-1	-2	0
Tensile strength	MPa	6.4	8.4	6.6	Δ	%	9.6	17.1	4.1
Modulus 50 %	MPa	2.2	3.2	2.8	Δ	%	-10.0	-5.8	-3.5
Modulus 100 %	MPa	2.6	4.5	3.9	Δ	%	-9.5	-3.5	-1.3
Modulus 200 %	MPa	3.1	5.8	4.9	Δ	%	-5.0	6.4	6.3
Modulus 300 %	MPa	3.9	7.6	6.1	Δ	%	0.8	8.9	14.4
Elongation at break	%	404	340	332	Δ	%	-1.8	10.0	-2.5
Weight					Δ	%	2.7	1.9	2.8
Volume					Δ	%	3.9	2.8	3.8