Technical Bulletin
Therban AT

Case Study: Timing belt recipe

Therban AT - Case Study Timing Belt
Scope of Study

Therban AT* is tested in a typical timing belt recipe.

Focus of this study is the processing behaviour of the resulting compounds.

* Therban AT VPKA 8966

Therban AT - Case Study Timing Belt
Conclusion

Strong improvements in viscosity of compounds without sacrificing product properties can be observed using Therban AT* in comparison with Standard HNBR´s*.

* Therban AT VPKA 8966
** Standard 34 ACN / ML 60 and ML 70

Therban AT - Case Study Timing Belt
Mixing

Using Therban AT* the filler distribution is observed to be excellent and of a high degree of uniformity within the compound.

In comparison to the use of Standard HNBR grades the mixing process can be shortened and temperatures can be decreased. Hence also the energy consumption is reduced.**

* Therban AT VPKA 8966
** Standard 34 ACN / ML 60 and ML 70

Therban AT - Case Study Timing Belt
Rheology

- ✓ **Compound Mooney viscosity using Therban AT* decreases by 23 / 18 ME compared to HNBR standard grades****
- ✓ **RPA results: Parallel shift of properties at all frequencies and amplitudes towards lower viscosity indicates better processability and flow properties for all typical rubber processes**
- ✓ **Increased scorch resistance can be observed with AT content due to lower initial Mooney viscosity.**

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Therban AT - Case Study Timing Belt

Vulcanizate Properties

A slightly lower crosslinking density of the vulcanizate is explained by the lower molecular weight of the Therban AT polymer structure which statistically results in more loose ends that can not take part in physical crosslinks by entanglement. Properties can be adjusted by slightly higher peroxide dosage.

Comparing Therban AT with standard HNBR in a belt recipe

Timing belt recipe	1	2	3
HNBR1*	50		
HNBR 2**		50	
Therban AT***			50
Therban ART KA8796	75	75	75
N330	30	30	30
Zinkoxyd aktiv	2	2	2
Maglite DE	2	2	2
Vulkanox ZMB2/C5	0,4	0,4	0,4
Rhenofit DDA-70	1,4	1,4	1,4
PERKADOX 14-40 B-GR	7	7	7

Compound tests	1	2	3
Scorch MS-t5/140°C	12,5	12,7	12,9
Mooney ML1+4, 100°C	80	75	57
Rel. 30	5,8	5,7	3,7
MSR	0,58	0,56	0,66
MDR 180°C			
ts 01	0,4	0,4	0,4
t 10	0,46	0,49	0,48
t 50	0,92	0,92	1,01
t 90	3,88	3,68	3,9
t 95	5,17	4,87	5,11
S' min	0,91	0,85	0,57
S' max	36,9	36	32,1

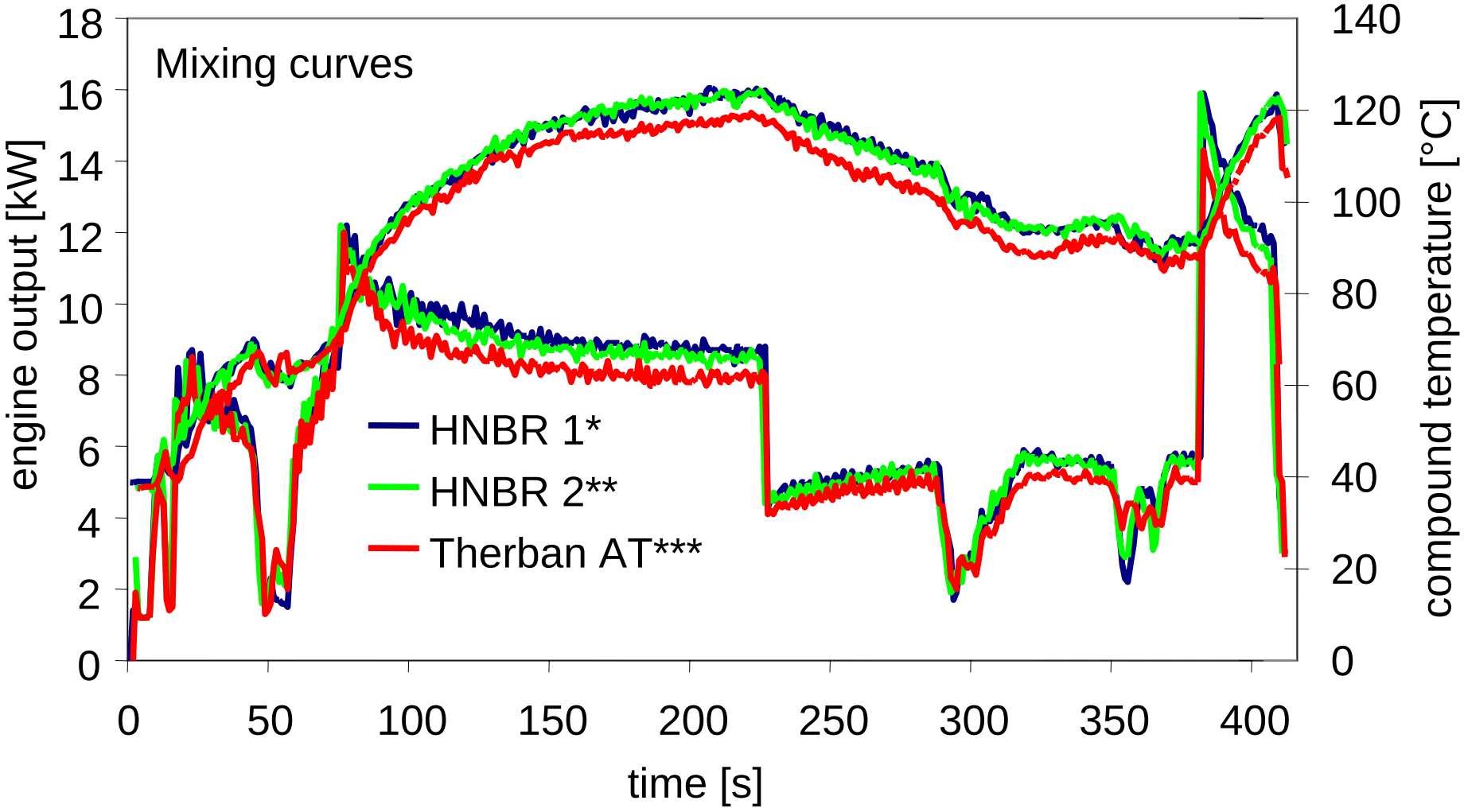
Vulcanizate tests	1	2	3
Tensile test			
Tensile strength	26,2	25,7	24,3
Elongation at break	216	219	219
M 50	4,7	4,6	4,4
M100	11,8	11,5	11,1
M150	19,1	18,6	17,7
M200	24,7	24,3	22,7
Hardness 23°C	80	80	79
Hardness 70°C	77	76	75
aging 7d 150°C			
aged tensile test			
Tensile strength	28	27,1	26
Elongation at break	144	139	136
M 50	8,7	8,8	8,7
M100	20,2	20,1	19,7
aged hardness 23°C	86	87	86
Hardness 70°C	84	84	82
DIN 53516 abrasion	65	64	70
Compression set: DIN 53517 A			
Temperature = -10°C, time = 24 h			
C.S. %	74,5	72,4	78,9
Temperature = 23°C, time = 72 h			
C.S. %	18,5	19,4	20,7
Temperature = 100°C, time = 72 h			
C.S. %	36,2	36,5	37,1
Temperature = 150°C, time = 168 h			
C.S. %	56,9	57,2	57,5

* Standard 34 ACN / ML 70

** Standard 34 ACN / ML 60

*** Therban AT VPKA 8966 (34 ACN / ML 39)

Mixing



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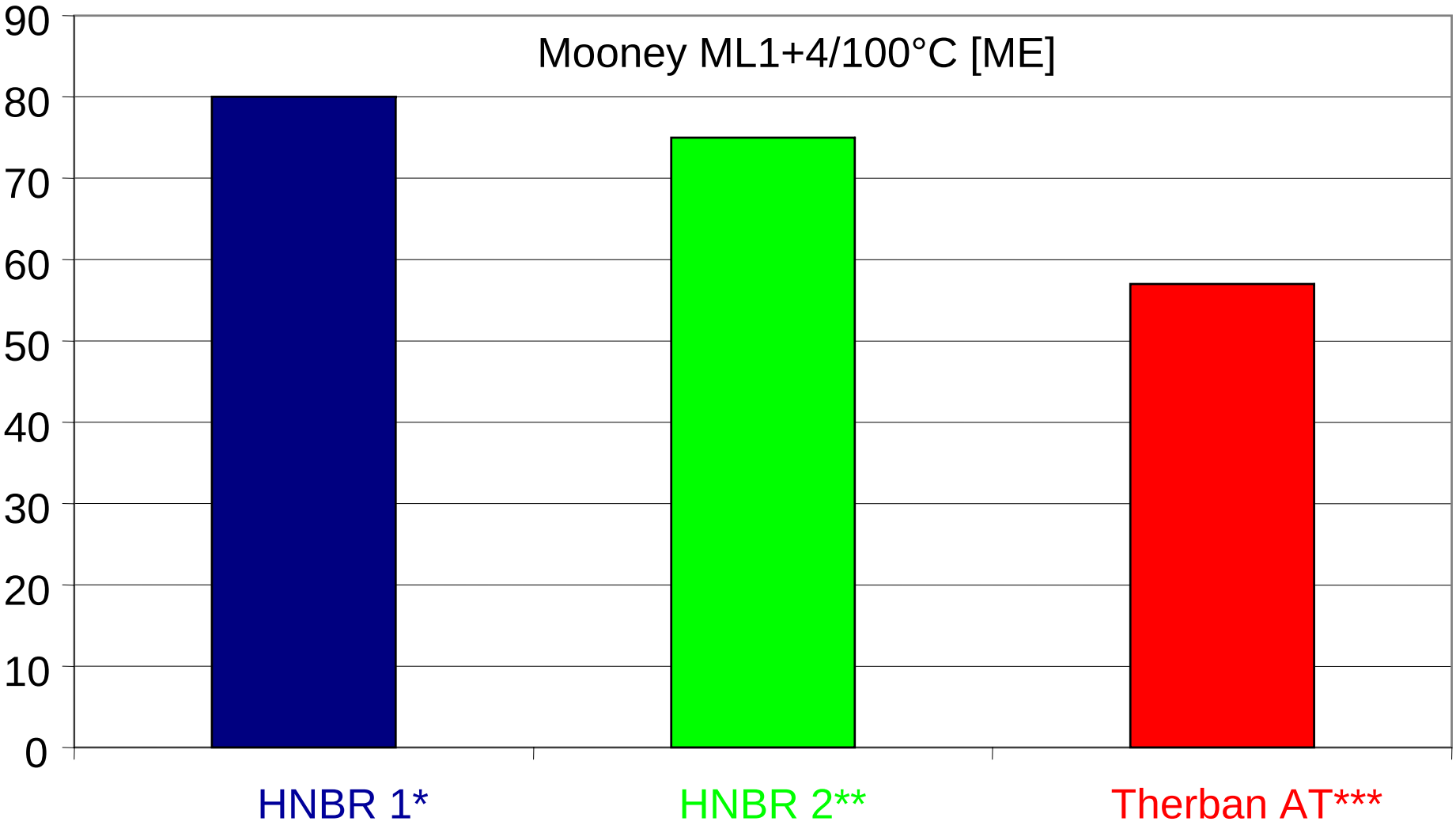
Compound viscosity



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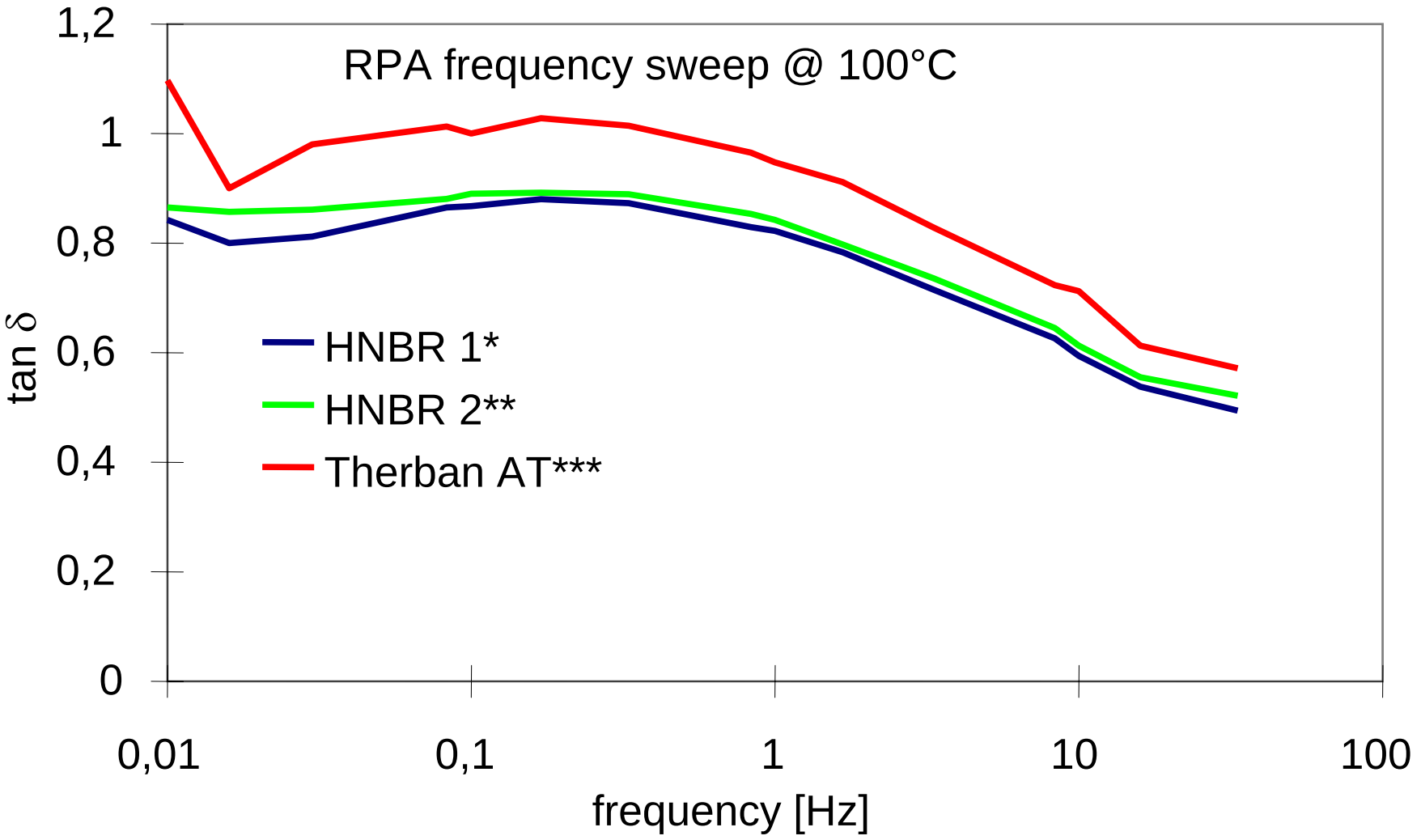
RPA measurement of compound



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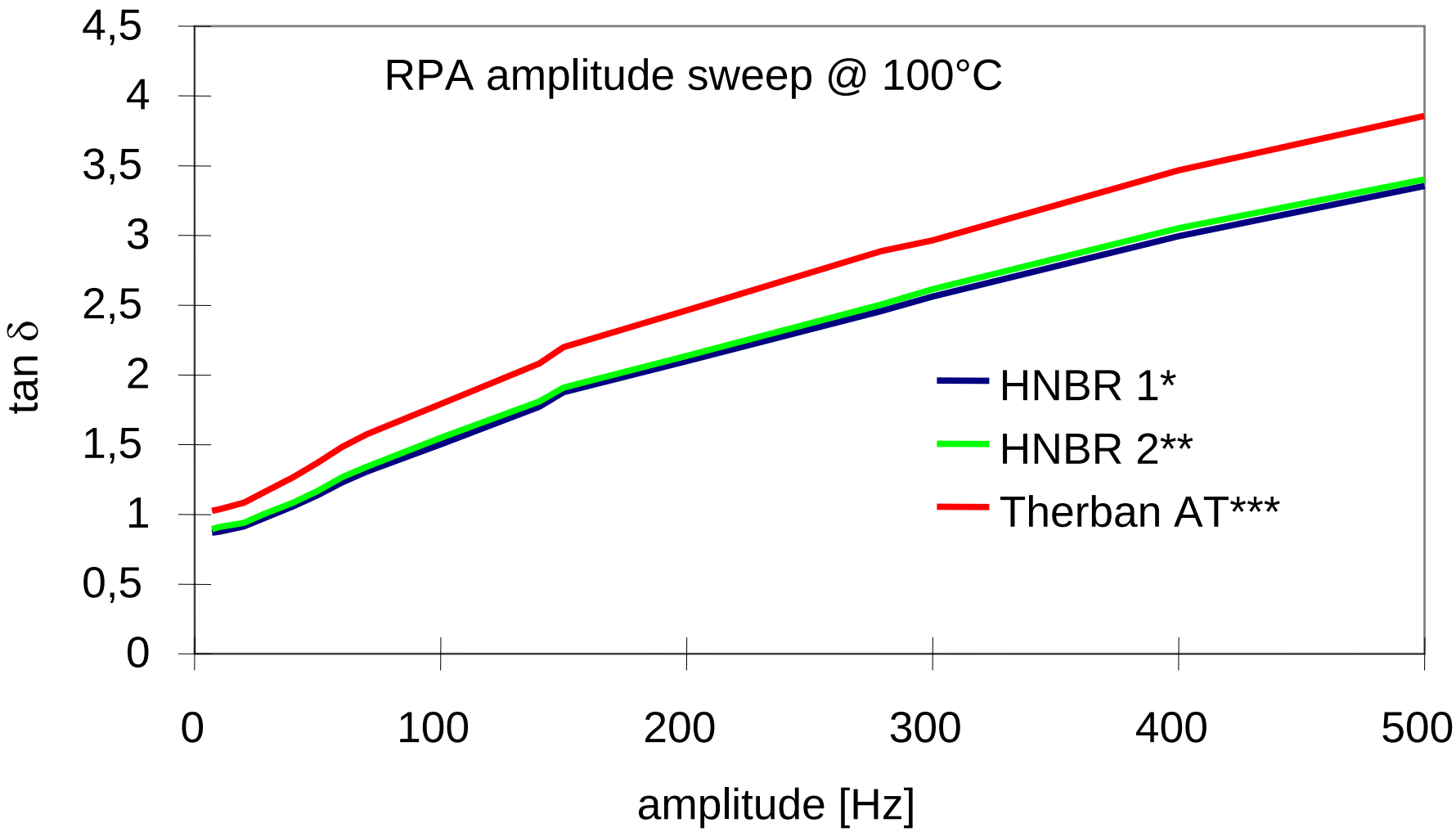

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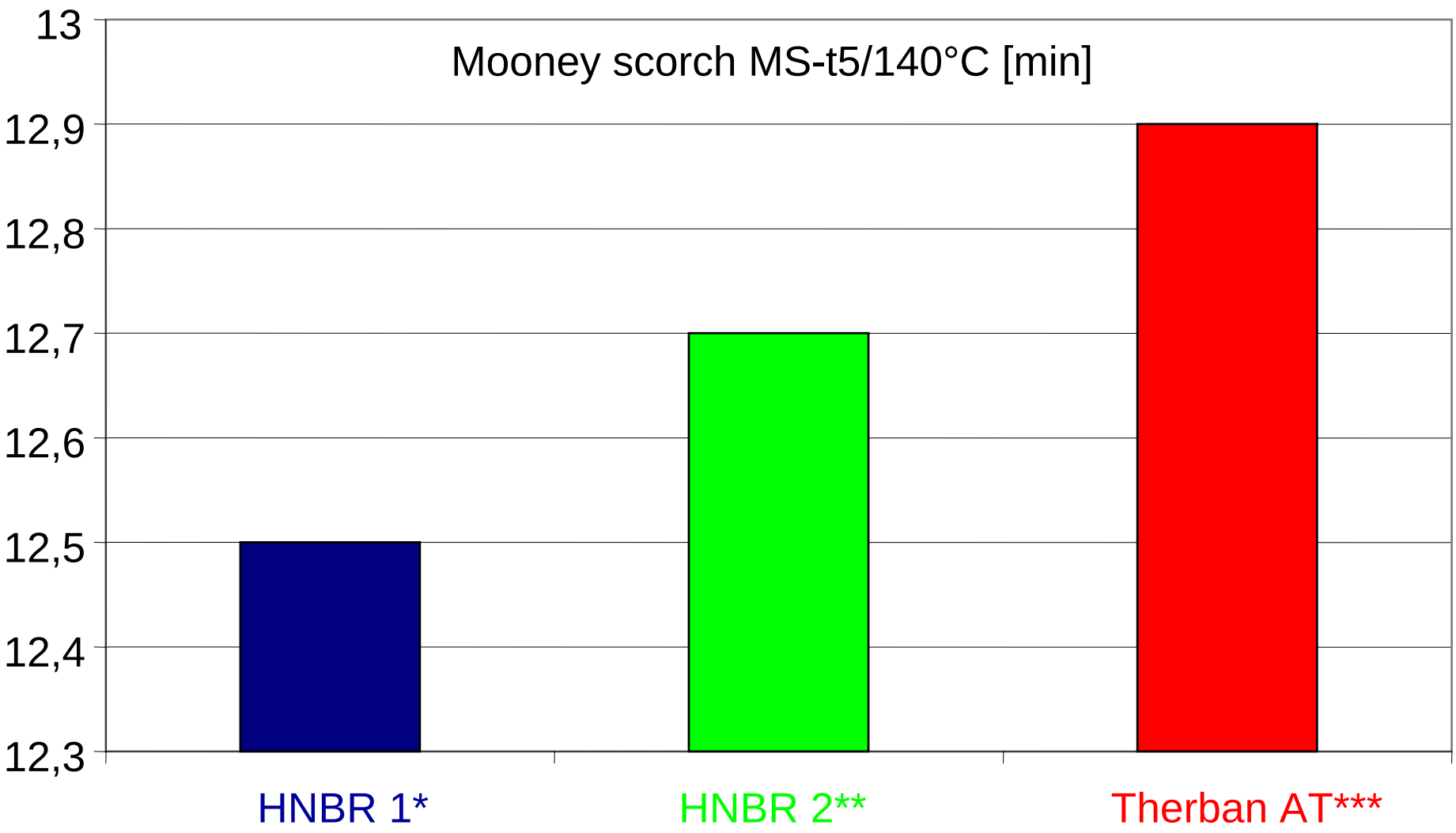
Scorch resistance



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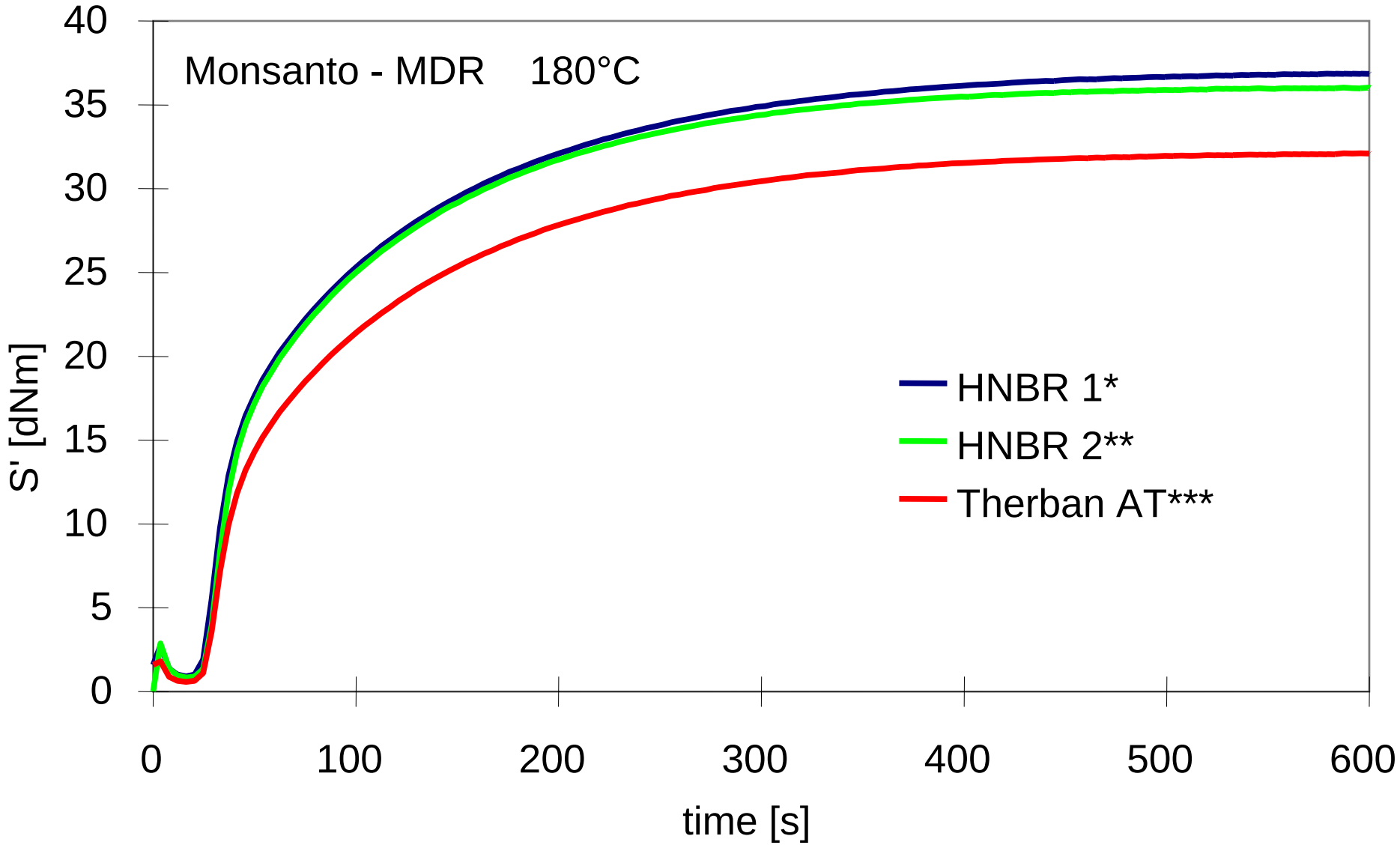
Vulcanization



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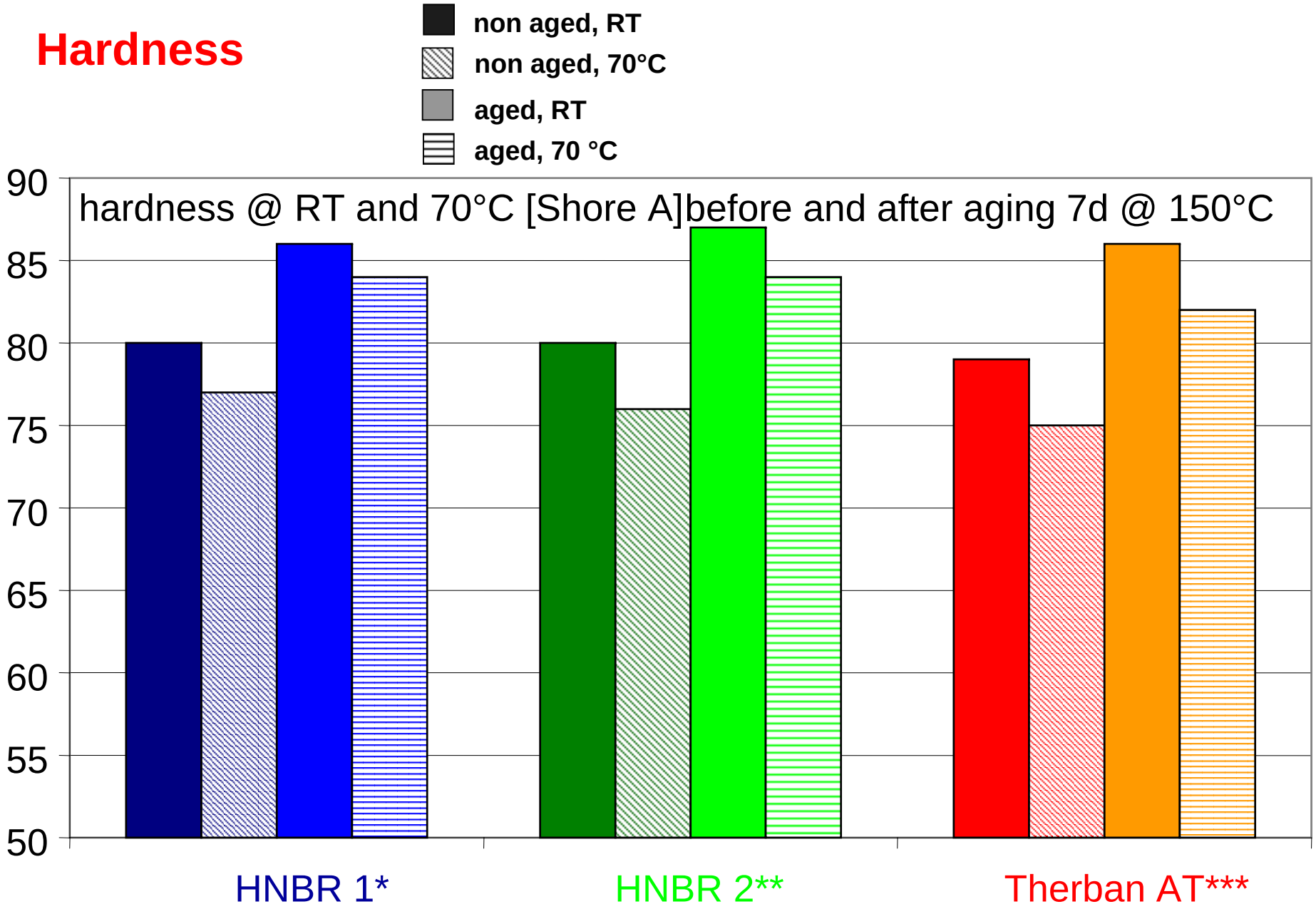
Hardness



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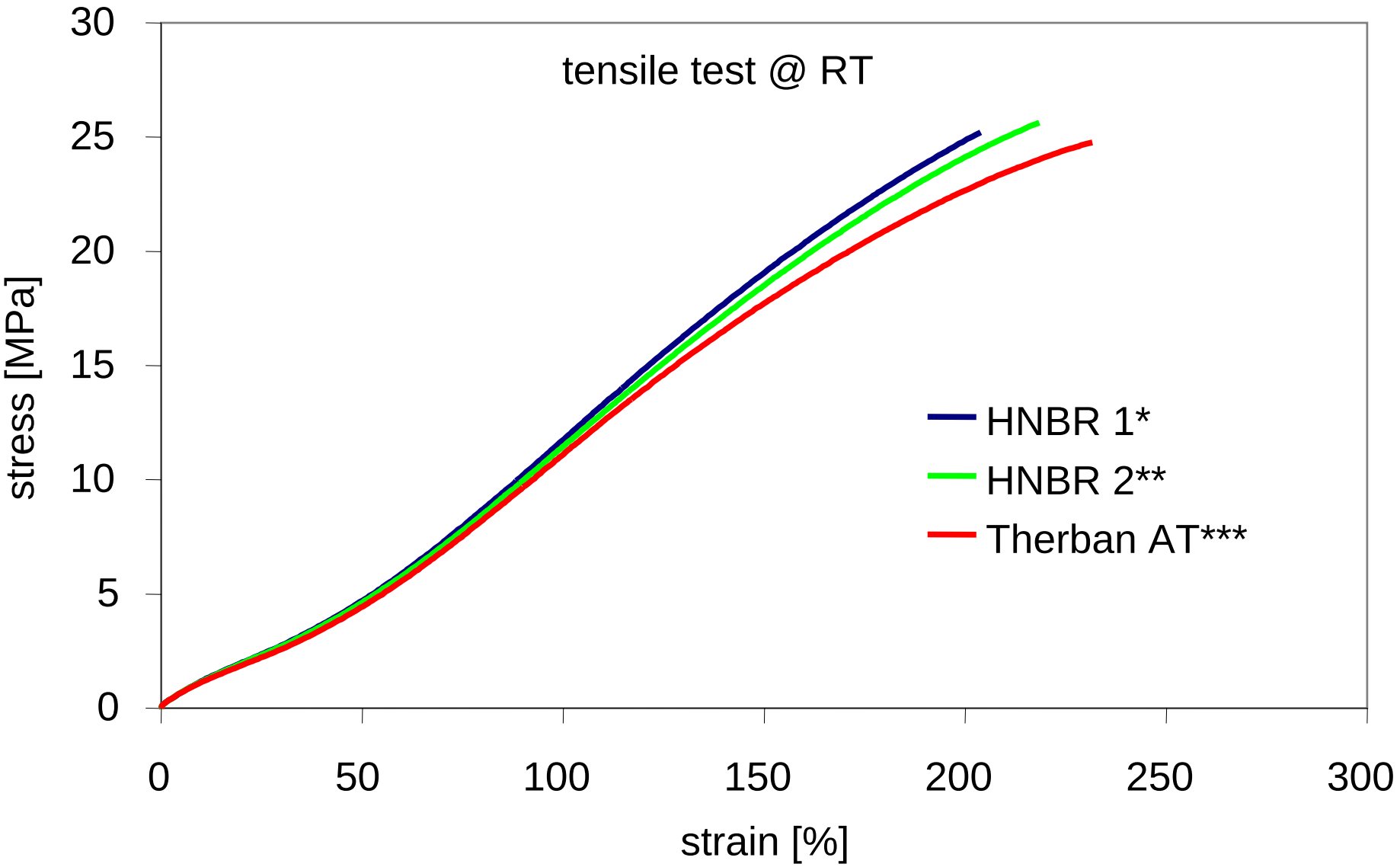
Tensile test



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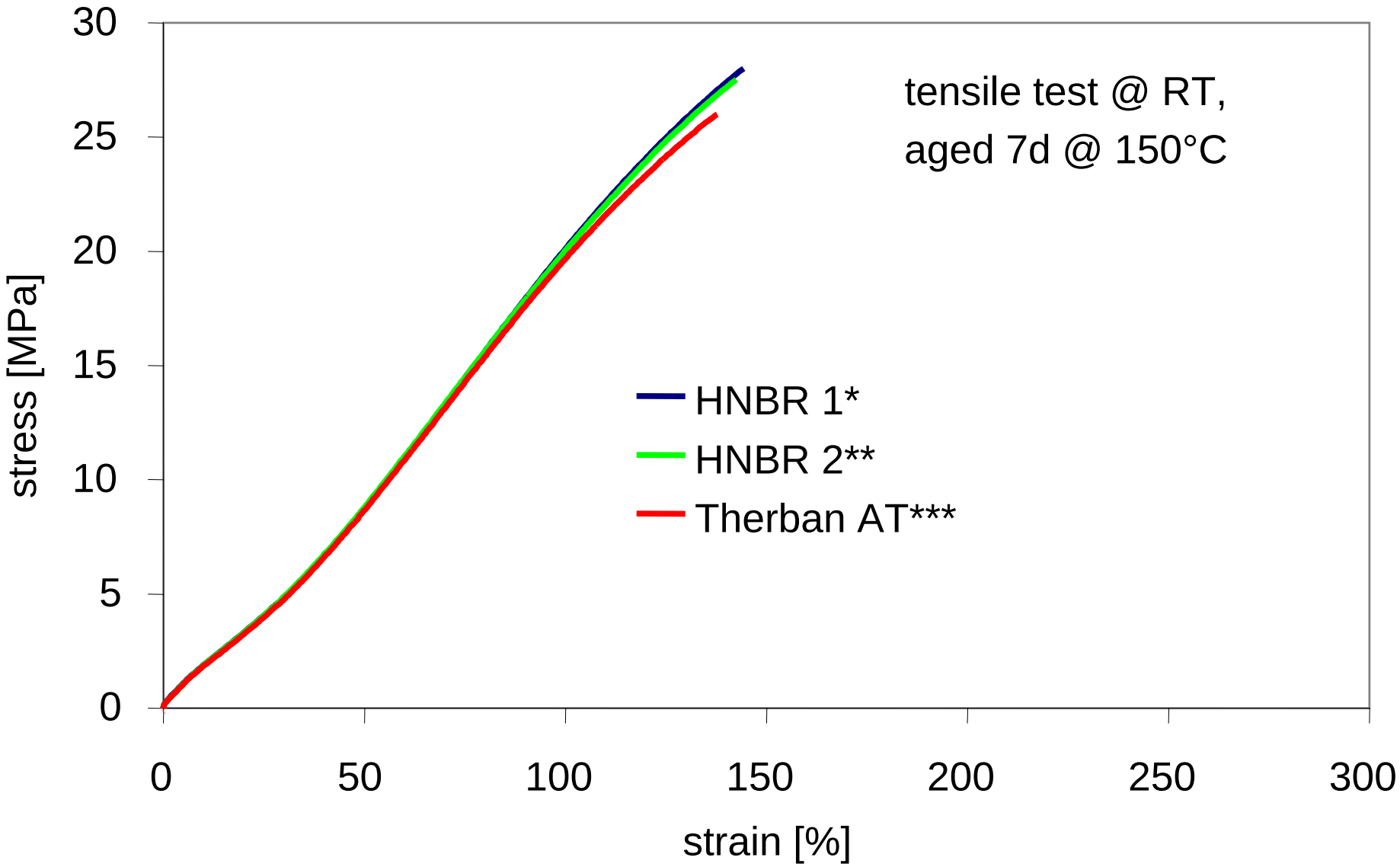

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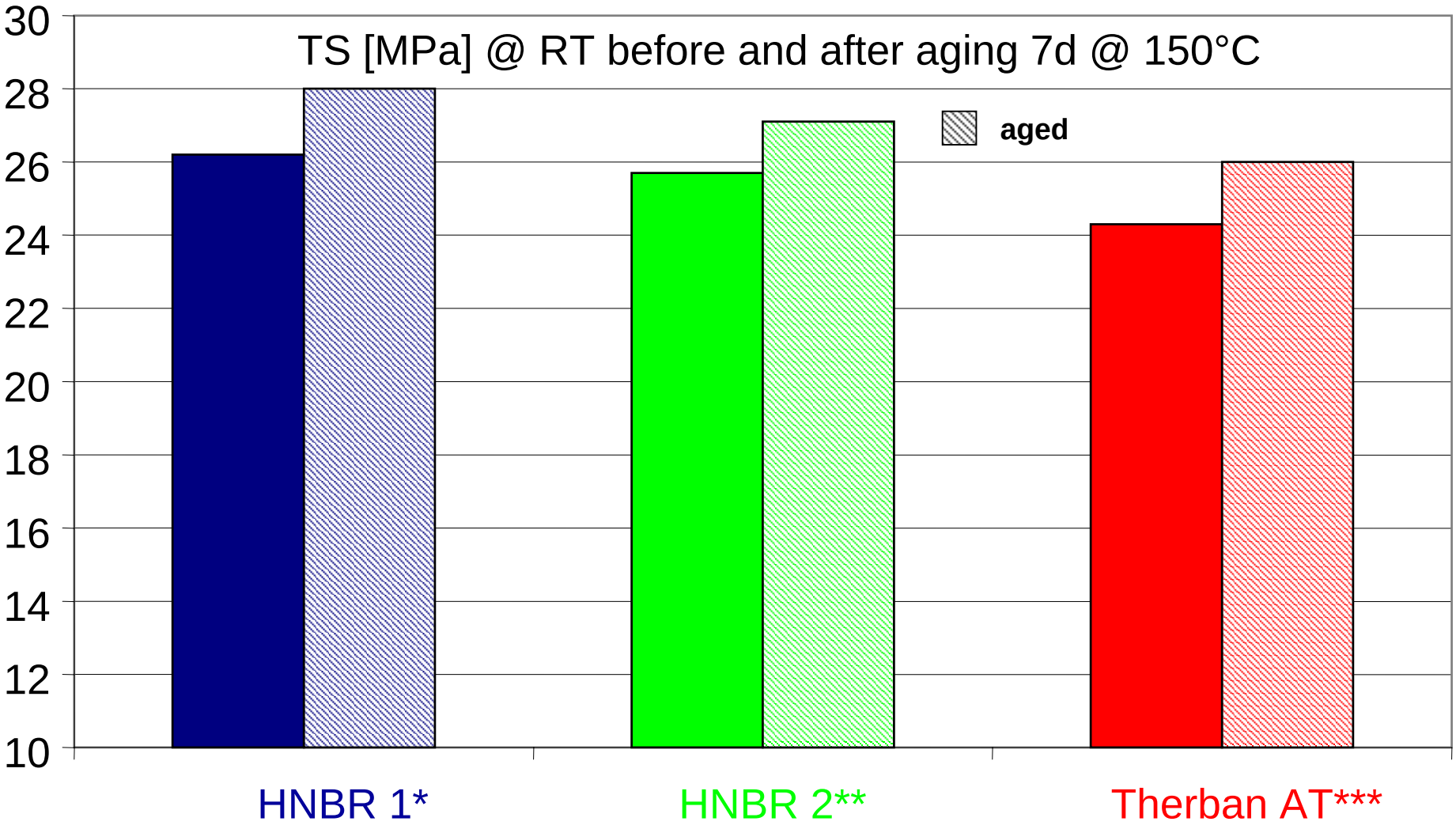
Tensile strength



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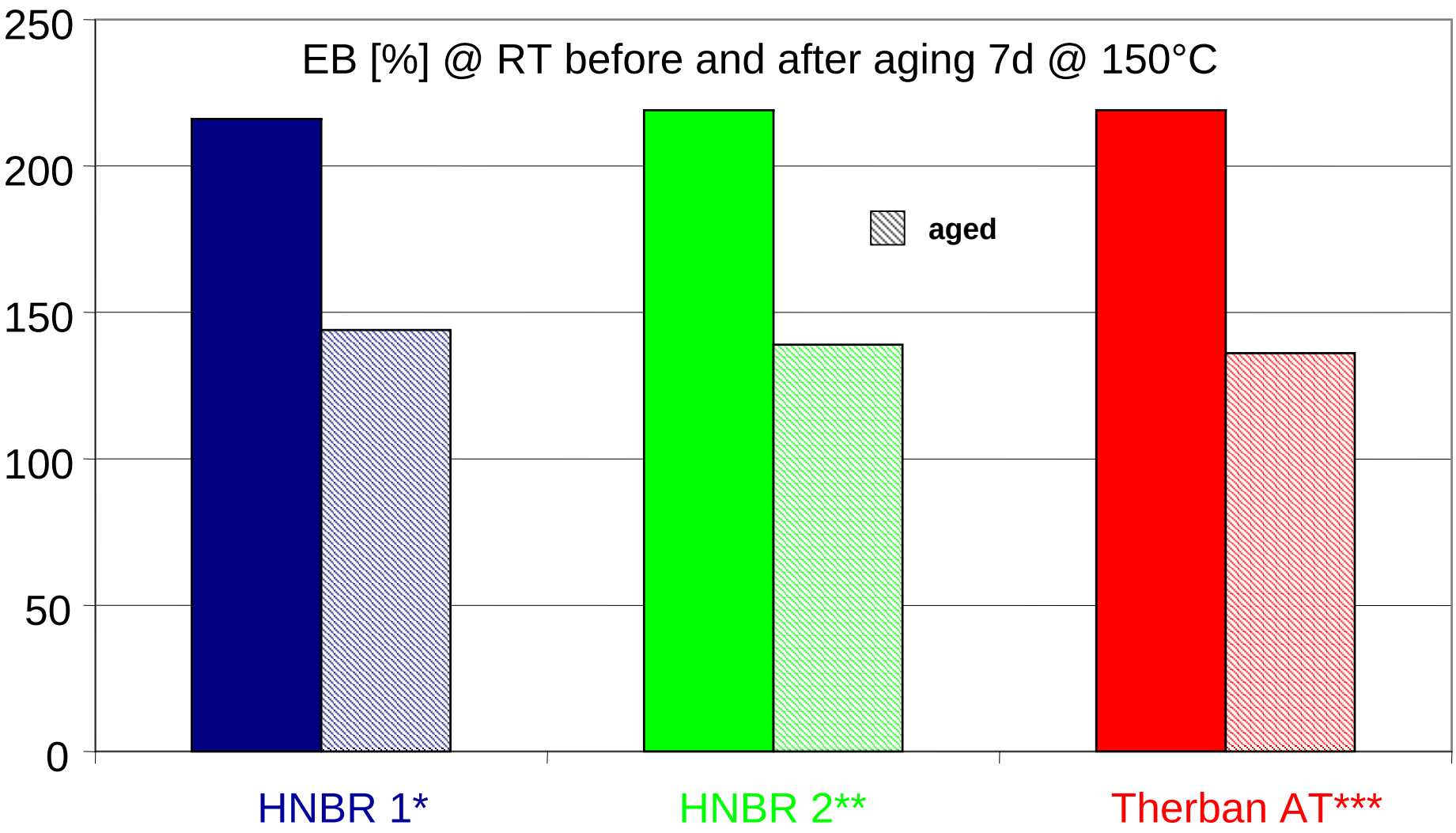
Elongation at break



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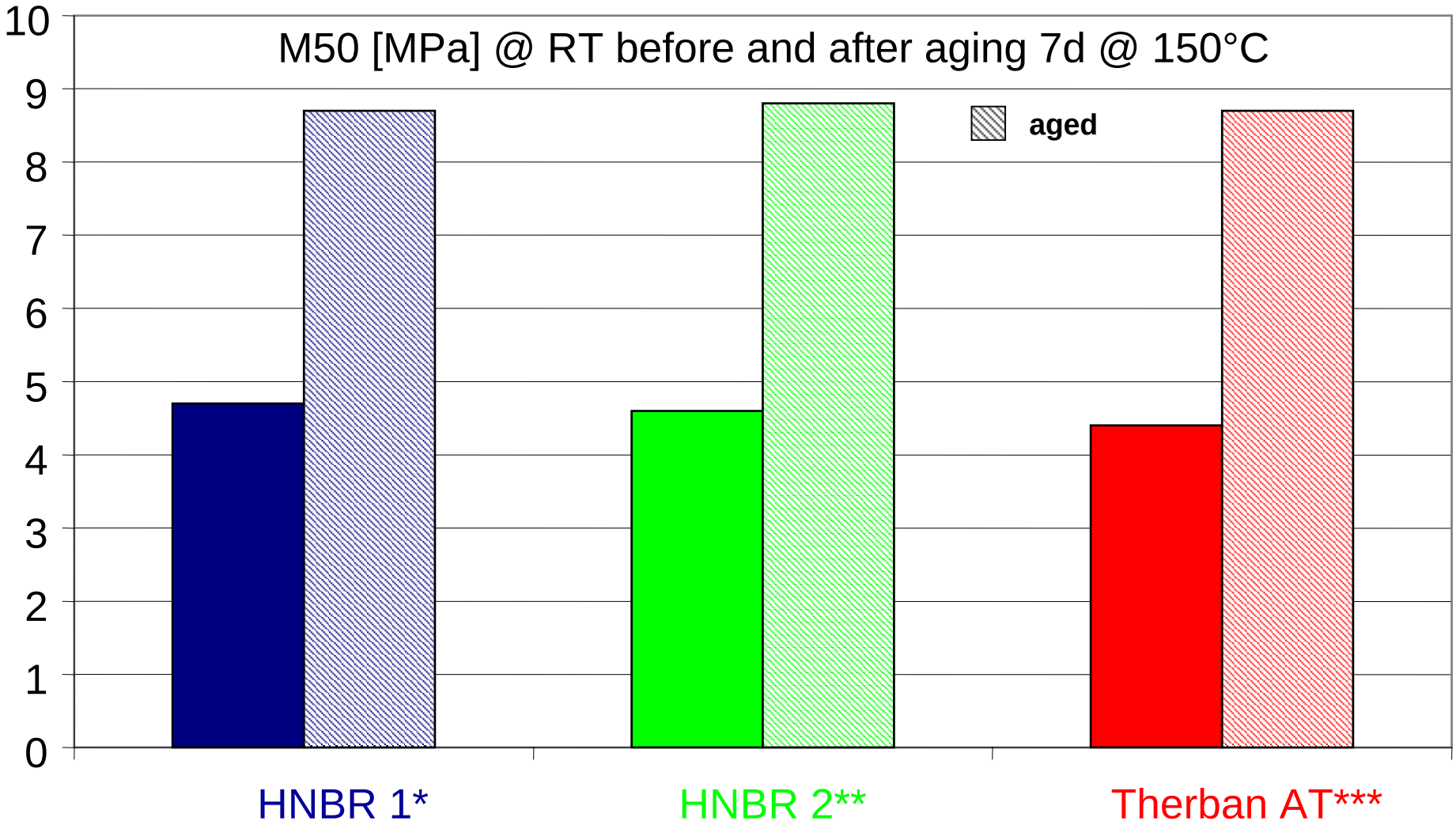
Modulus



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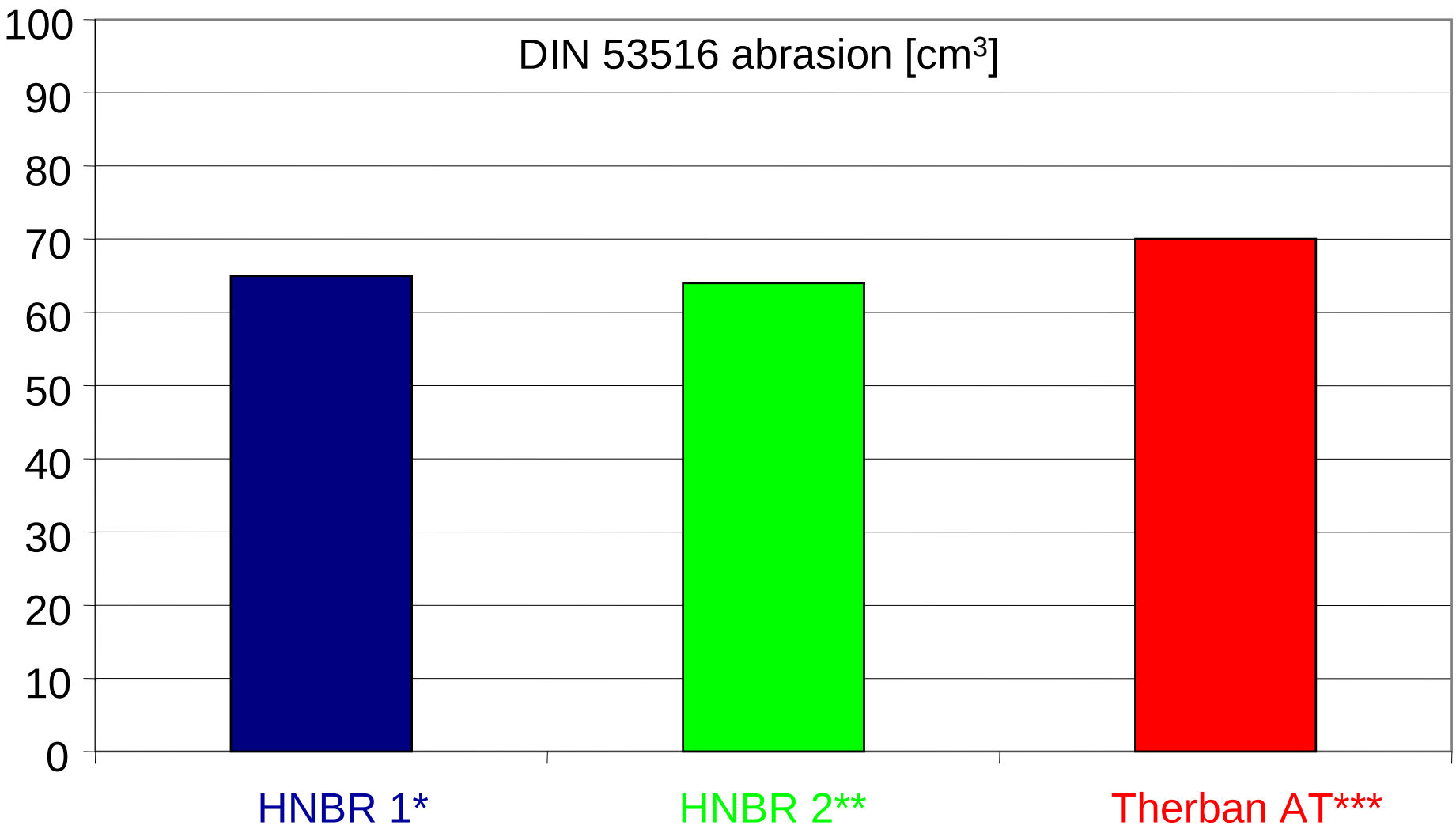
Abrasion



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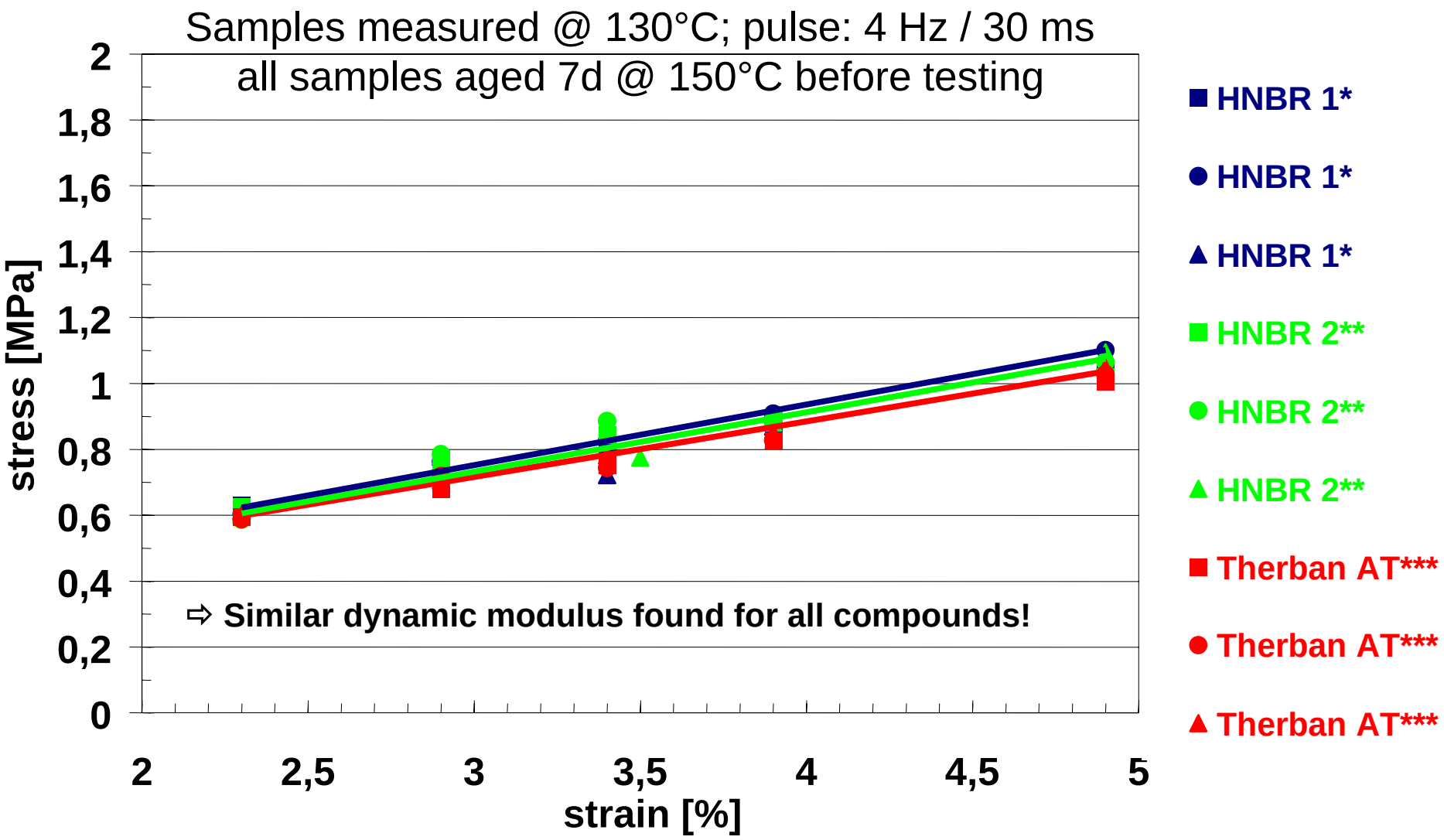
Tear analyzer



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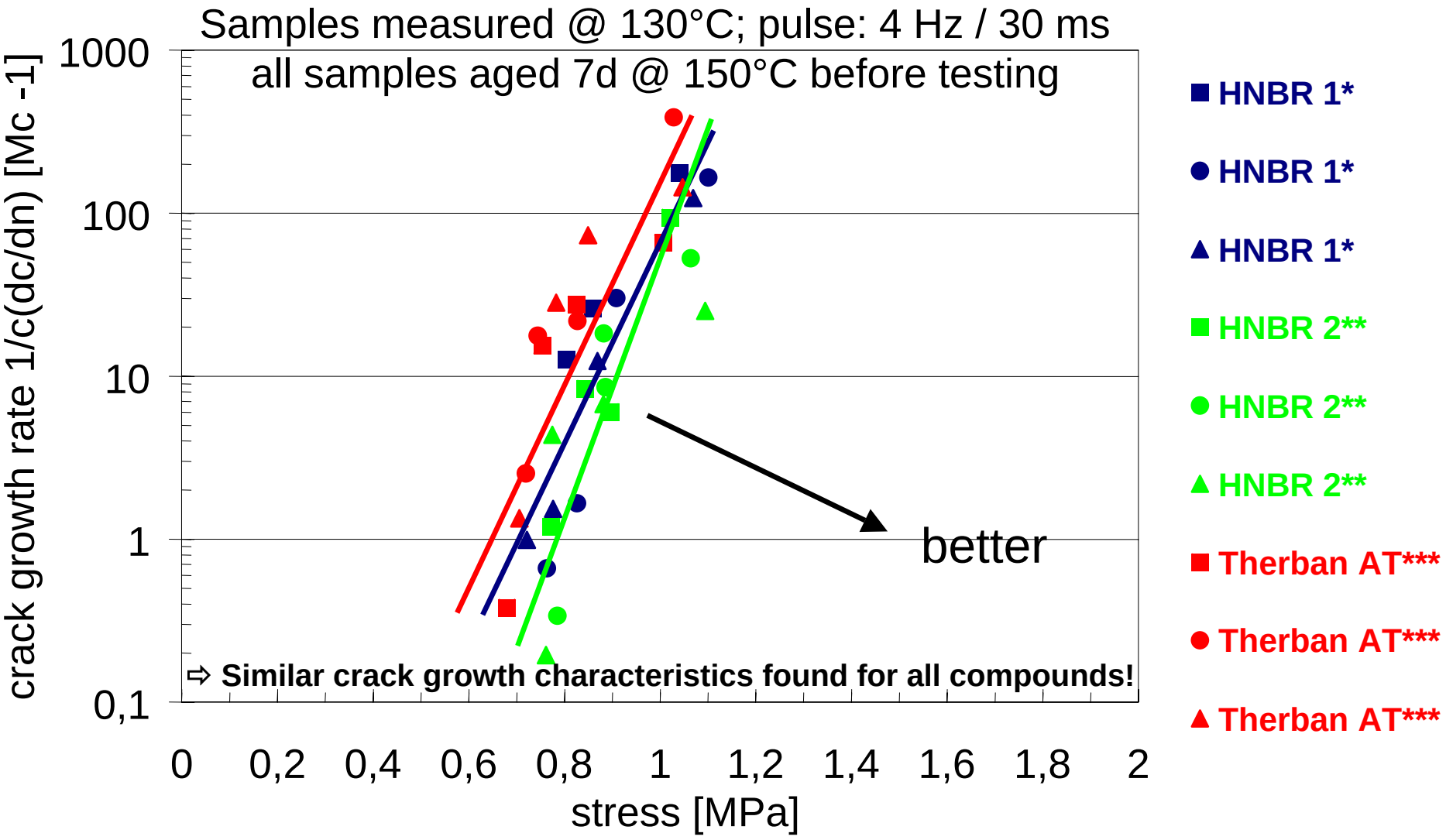

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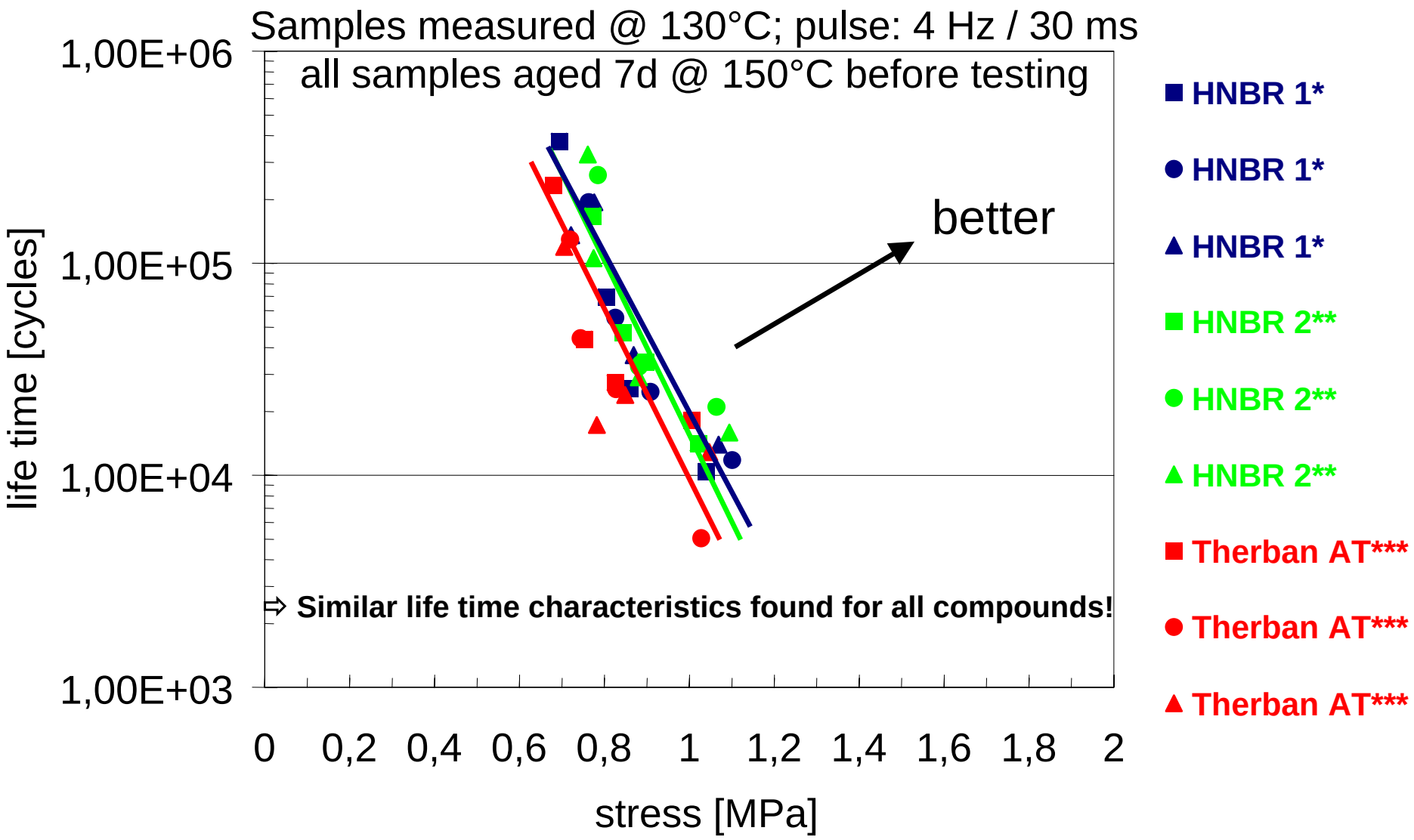

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Conclusions tear analyzer test:

✓ **Marginal differences between compounds in modulus and life time characteristics are due to small differences in crosslink density and can be offset by a slight increase in dosage of crosslinker.**

✓ **Advantages in processing properties can be realized without sacrificing belt properties.**