Technical Bulletin
Therban AT

Case Study: Standard Cable Sheet Recipe

Comparing Therban AT with standard HNBR in a cable recipe

Extrusion test results: Garvey profiles

Extrusion test	1	2	3
Mass output [g/min]	245	266	294
Volume output [ml/min]	2,74	2,98	3,29
Torque [Nm]	99	97	90
Mass pressure [bar]	119	109	89
Axial power [MPa]	2,4	2,4	1,9
Die swell [%]	27	22	18
Extrudate temp. [°C]	90	90	91
Energy consumption [kW]	5,7	5,1	4,3

Extrusion tests where performed on a Troester GLS 45k extruder

Screw diameter:	45 mm
Screw length:	465 mm, 10D
Screw pitch code:	1 1 2 3 4 1
Motor power:	10,6 kW
Cylinder temp.:	60 °C
Mouth peace temp.:	85 °C
Screw temp.:	30 °C
screw turns 1/min:	25
die / diameter:	Garvey profile, 7,59 mm

* Standard 34 ACN / ML 70 ** Standard 34 ACN / ML 60 *** Therban AT VPKA 8966 (34 ACN / ML 39)

Therban AT - Case Study Standard Cable Sheet Recipe
Scope of Study

Therban AT* is tested in a typical cable sheet recipe (flame resistant).

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

* Therban AT VPKA 8966

Therban AT - Case Study Standard Cable Sheet Recipe

Conclusion

Significant improvements in extrusion speed as well as extrudate surface quality can be achieved using Therban AT*.

* Therban AT VPKA 8966

Therban AT - Case Study Standard Cable Sheet Recipe
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 - Case Study Standard Cable Sheet Recipe
Rheology

- ✓ **Compound Mooney viscosity using Therban AT* decreases by 30 / 20 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.**

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

Therban AT - Case Study Standard Cable Sheet Recipe
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.

Therban AT - Case Study Standard Cable Sheet Recipe
Extrusion

- ✓ **20% higher volume output**
- ✓ **25% less mass pressure**
- ✓ **10% less torque (energy consumption)**
- ✓ **33% less die swell**
- ✓ **excellent profile edges**

results all observed at <u>one</u> given extruder parameter set up!!

Comparing Therban AT with standard HNBR in a cable recipe

Cable recipe	1	2	3
HNBR1*	100		
HNBR 2**		100	
Therban AT***			100
Apyral 120 E ($Al(OH)_3$)	160	160	160
Zinc-Borate	10	10	10
Stabaxol P	3	3	3
Zinc-stearate	1	1	1
EDENOL 888 (DOS)	6	6	6
Rhenofit DDA-70	1,4	1,4	1,4
Silane Si 208	4	4	4
Silquest RC-1 Silane	4	4	4
Rhenofit TRIM/S	0,7	0,7	0,7
PERKADOX 14-40 B-GR	6	6	6

Compound tests	1	2	3
Scorch MS-t5/140°C	7,4	8,4	10,8
Mooney ML1+4, 100°C	86	79	59
Rel. 30	8,7	8,7	5,6
MSR	0,49	0,48	0,57
MDR 180°C			
ts 01	0,4	0,4	0,5
t 10	0,63	0,68	0,77
t 50	1,7	1,84	2,11
t 90	4,85	5,16	5,57
t 95	6,24	6,58	7,04
S' min	1,89	1,8	0,93
S' max	27,57	23,46	19,37

Vulcanizate tests	1	2	3
Tensile test			
Tensile strength	12,9	11,9	11,1
Elongation at break	240	262	260
M 50	3,8	3,3	3,2
M100	7,9	7	6,5
M150	10,8	9,7	9
M200	12,5	11,4	10,5
M250	12,5	11,4	10,5
Hardness 23°C	78	77	75
DIN 53516 abrasion	165	201	214

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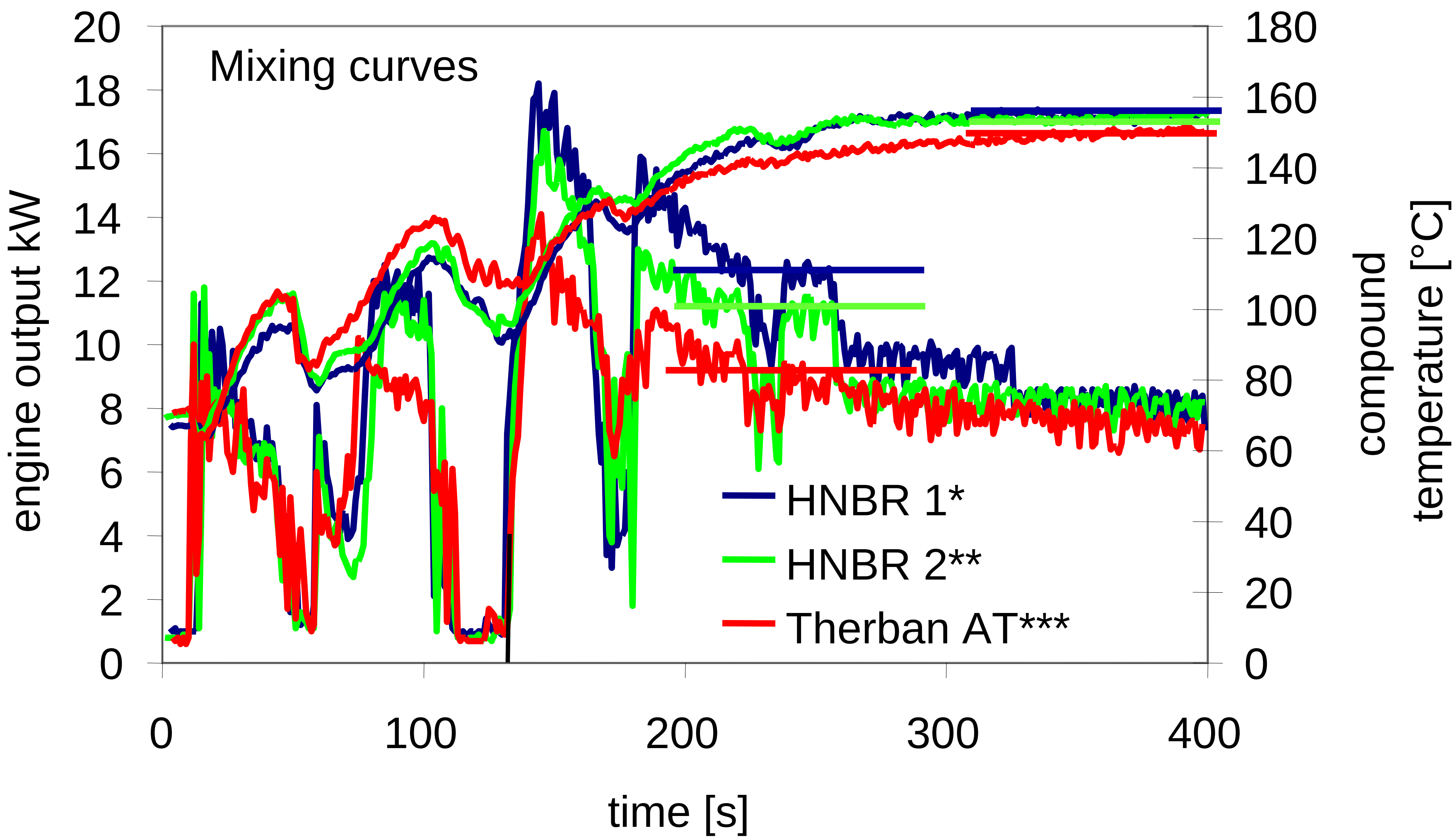
LANXESS

Mixing



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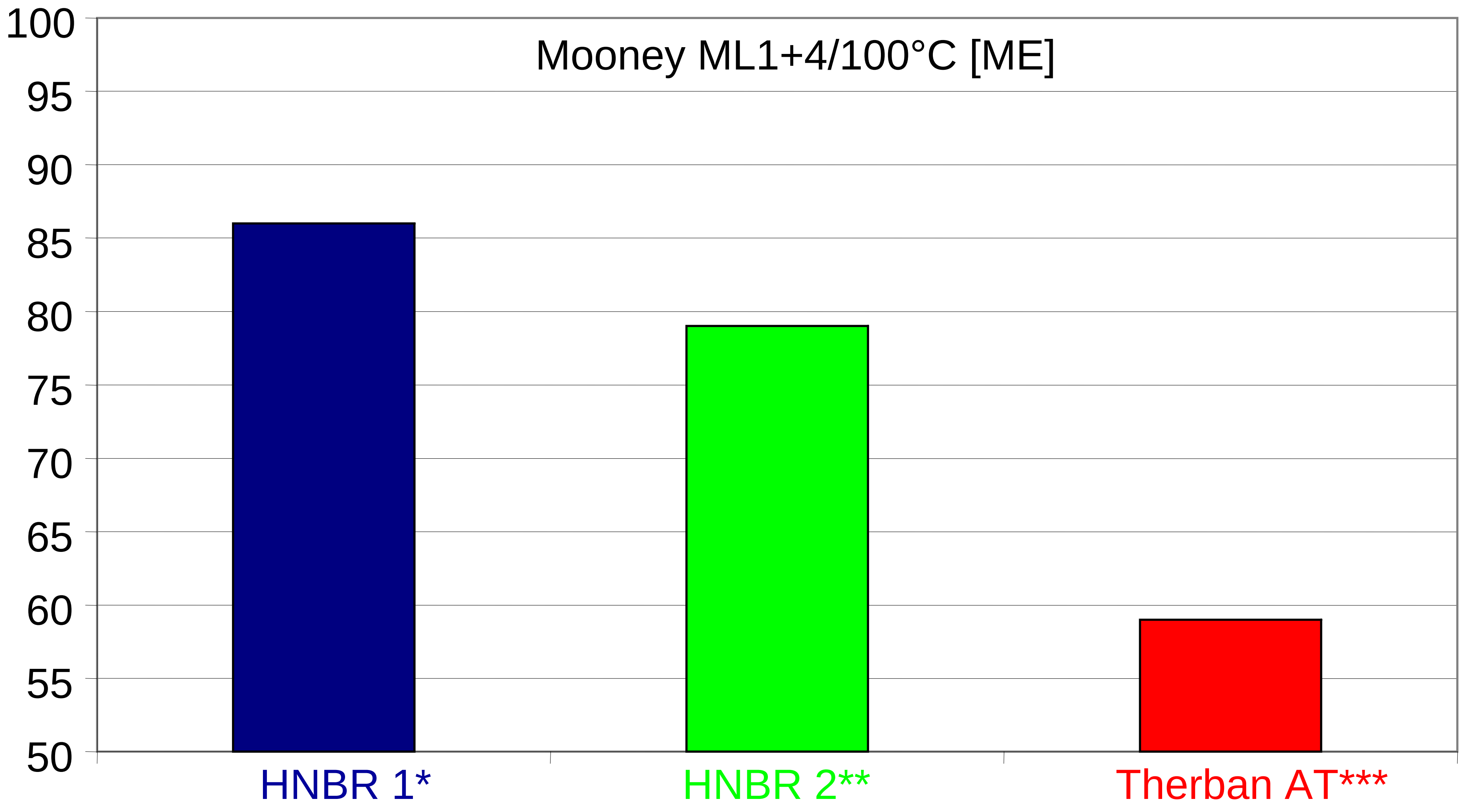
Compound viscosity



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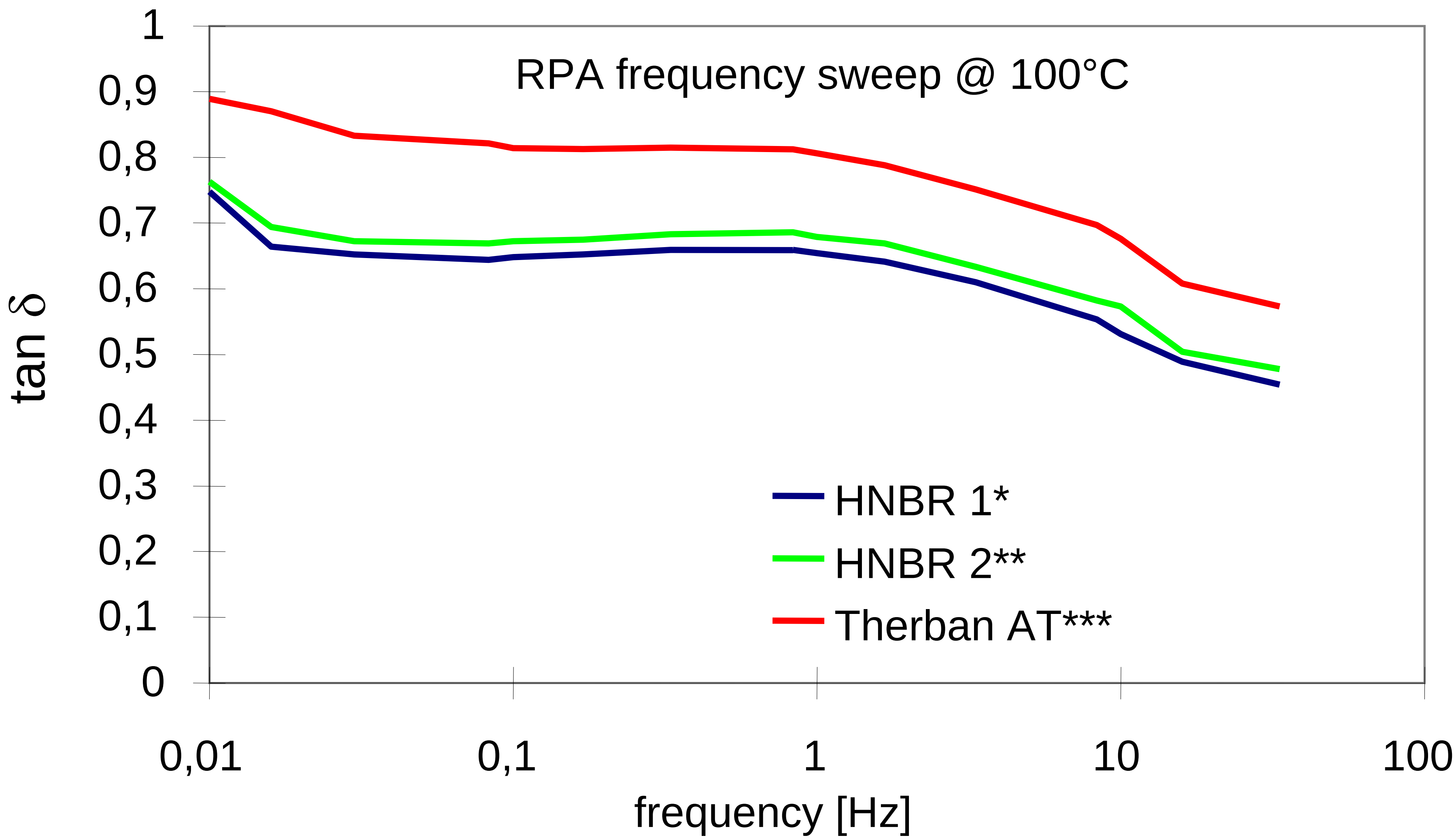
RPA measurement of compound



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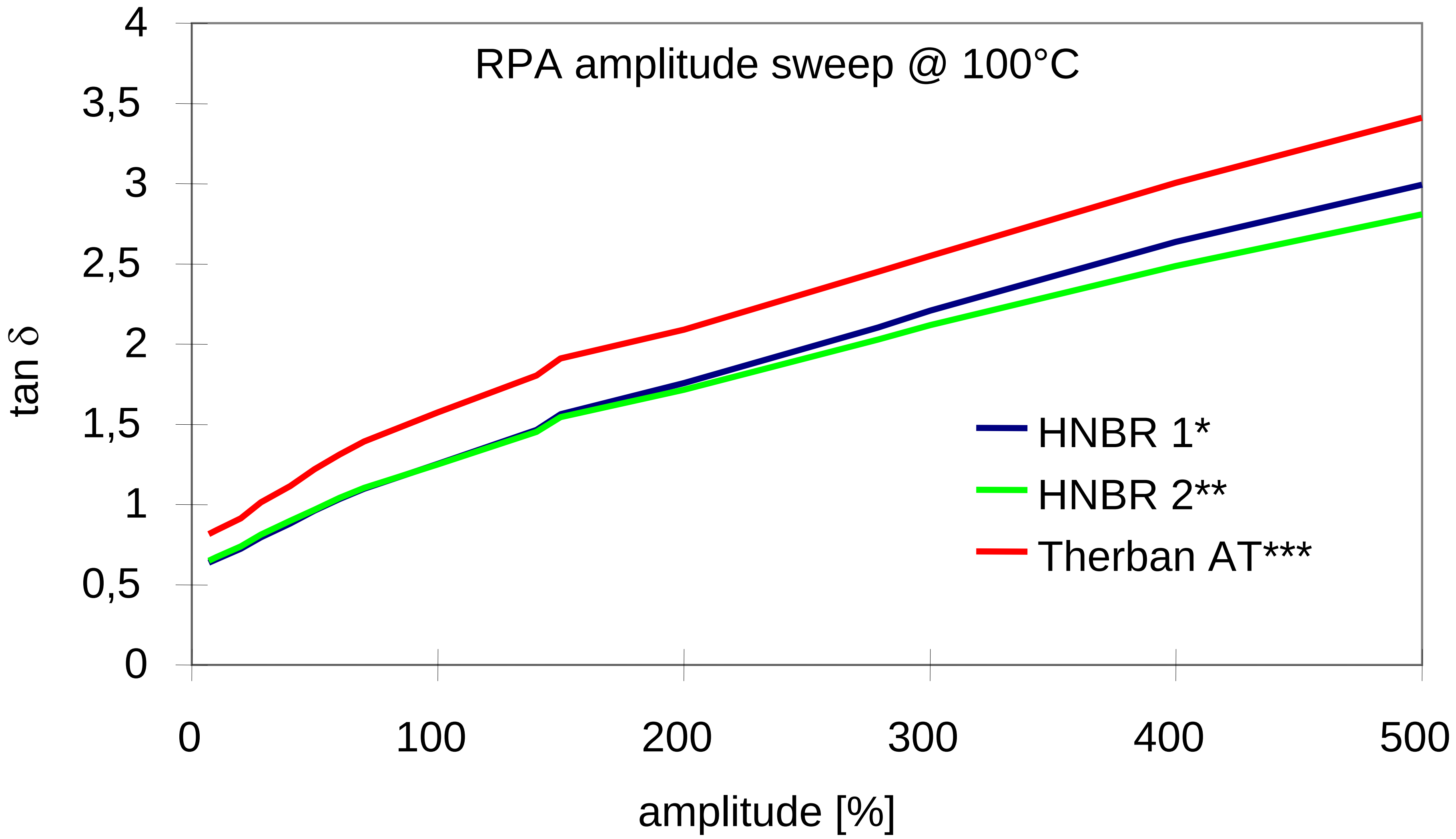
RPA measurement of compound



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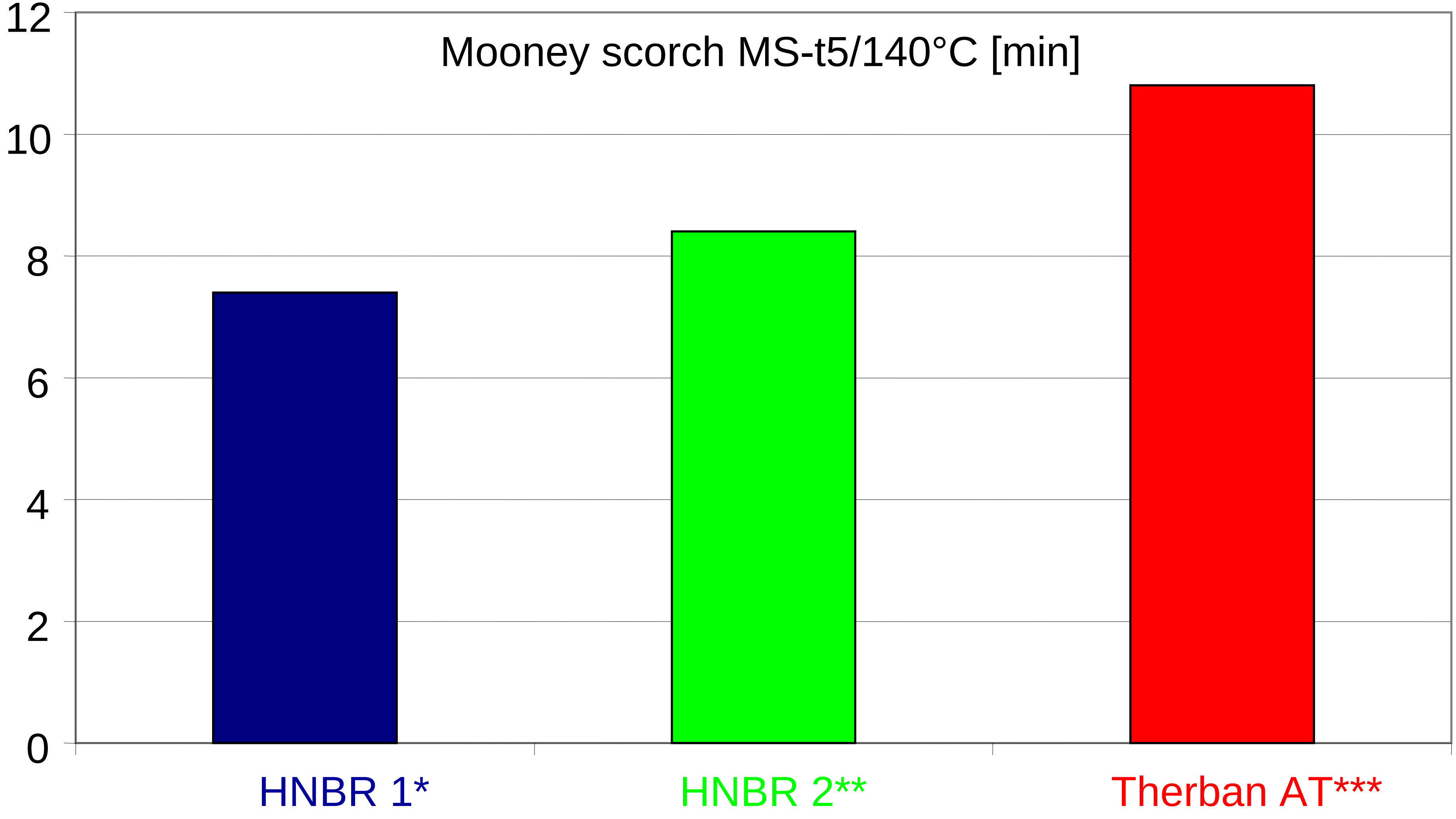
Scorch resistance



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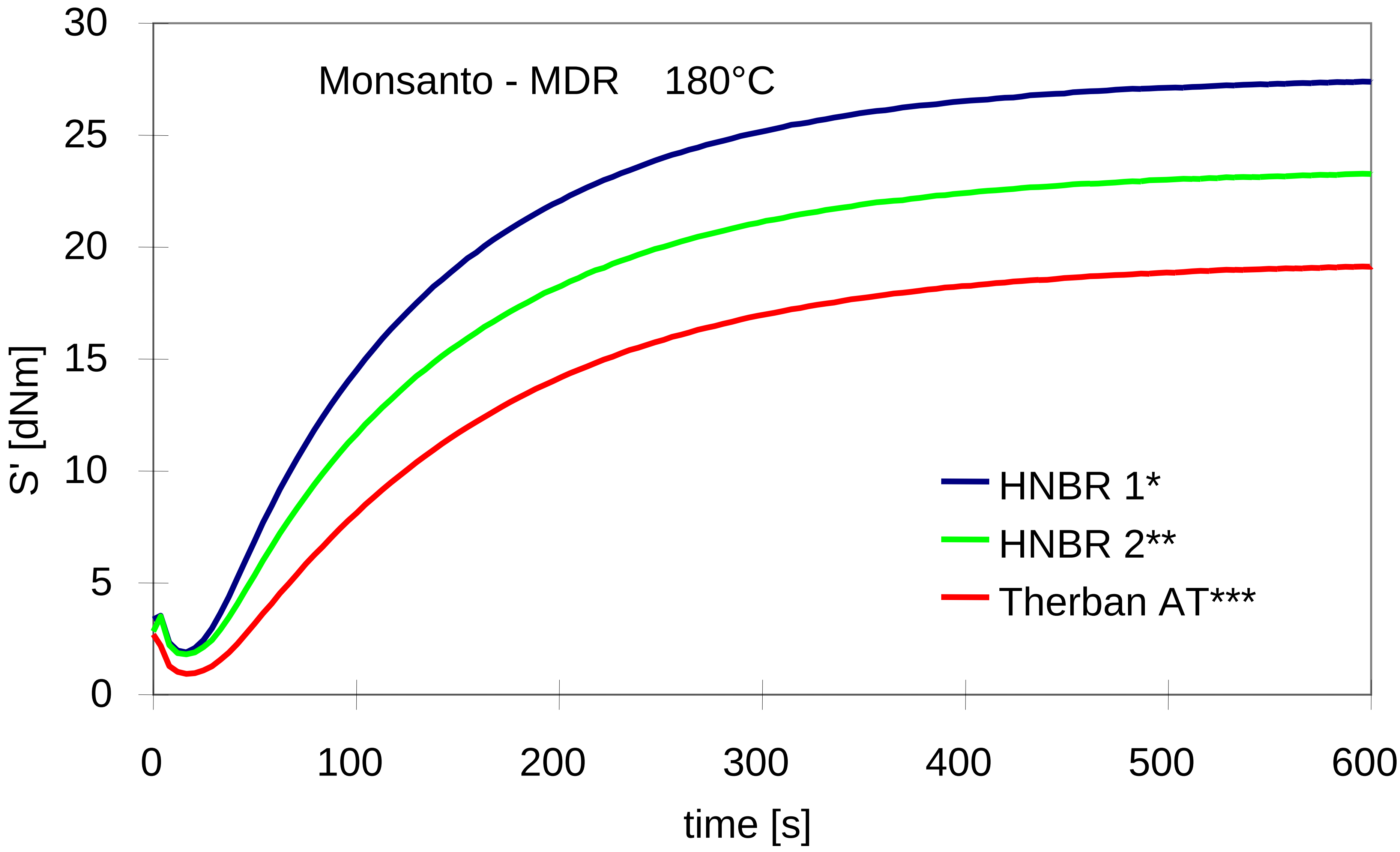
Vulcanization



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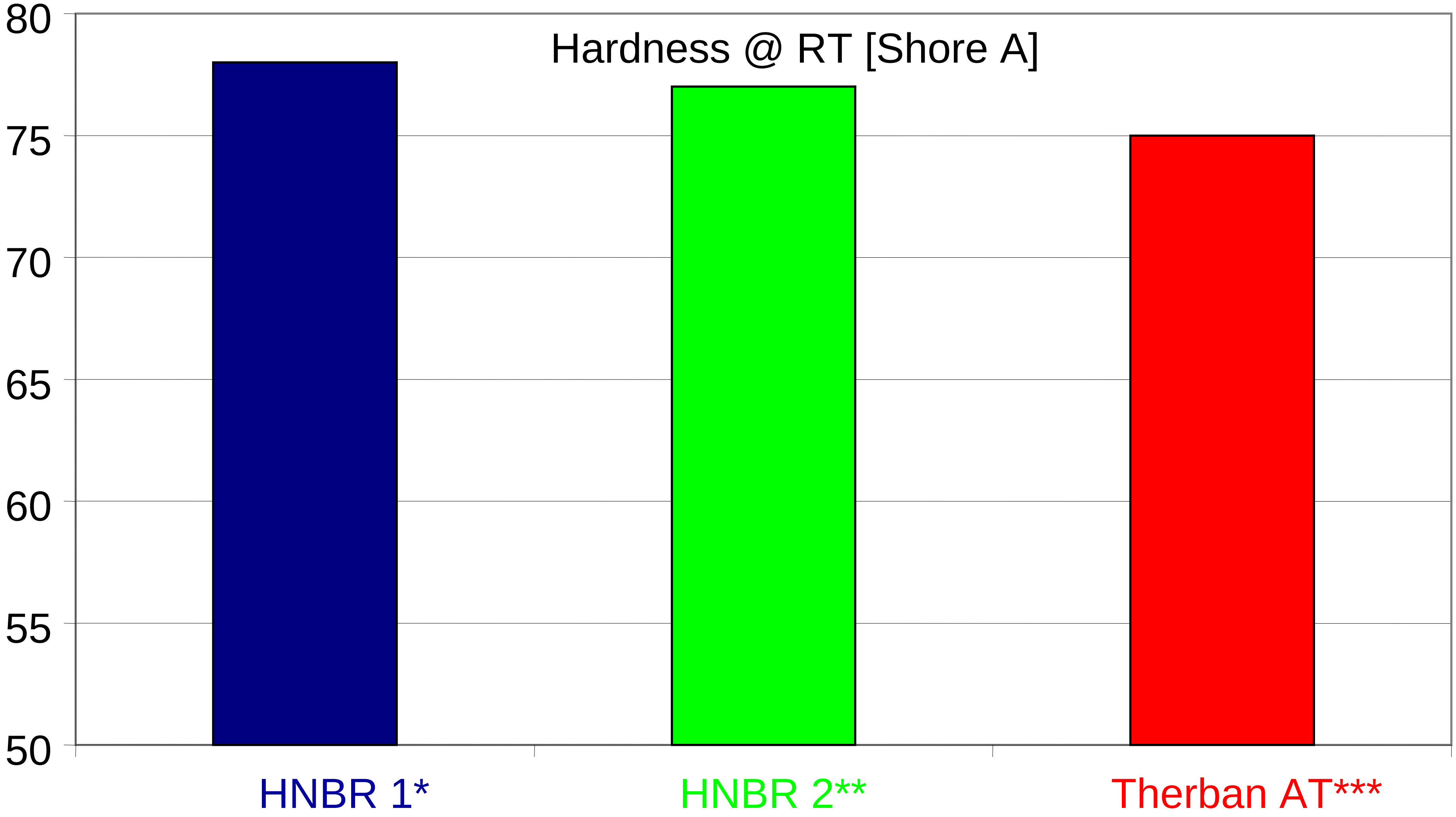
Hardness



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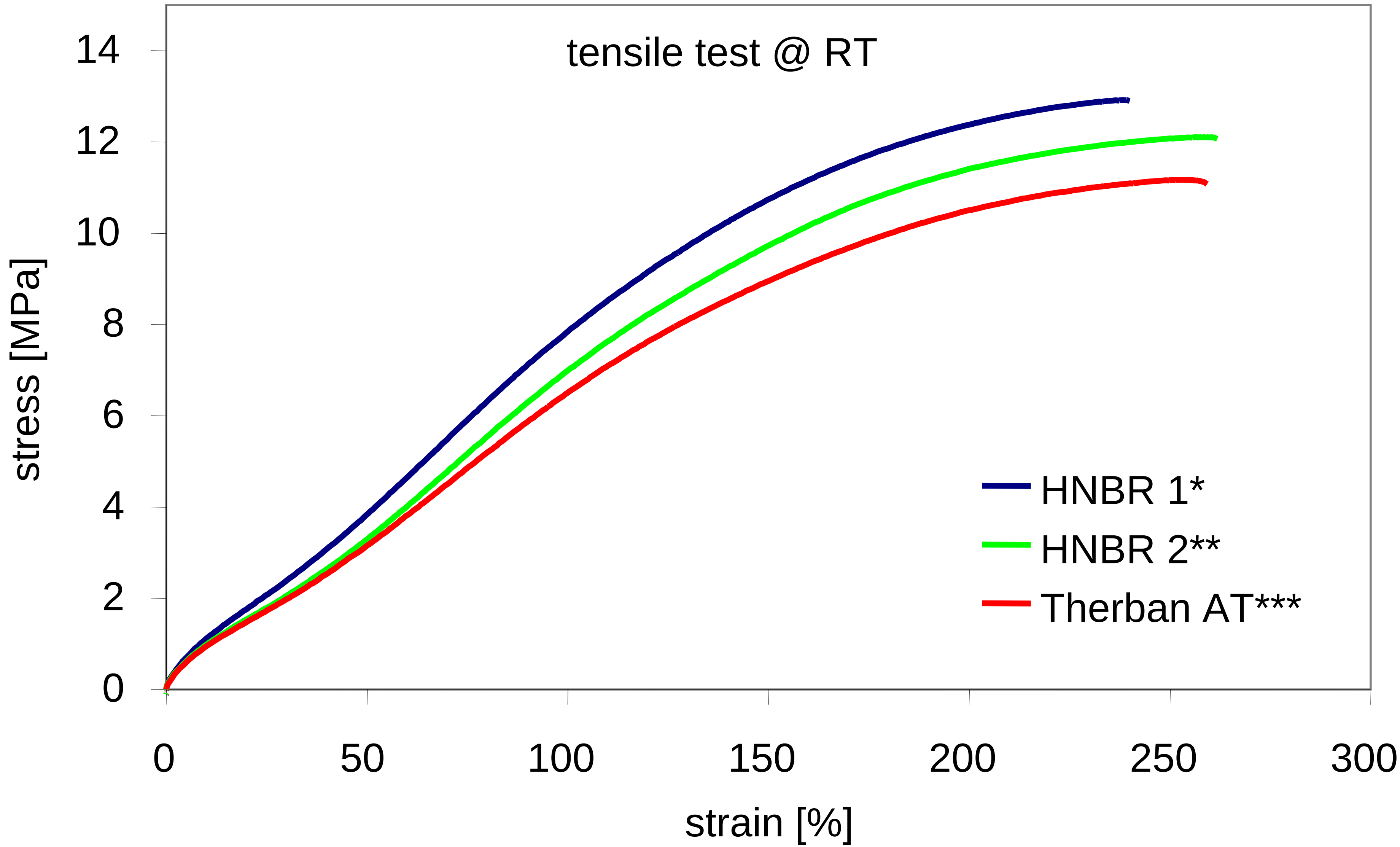
Tensile test



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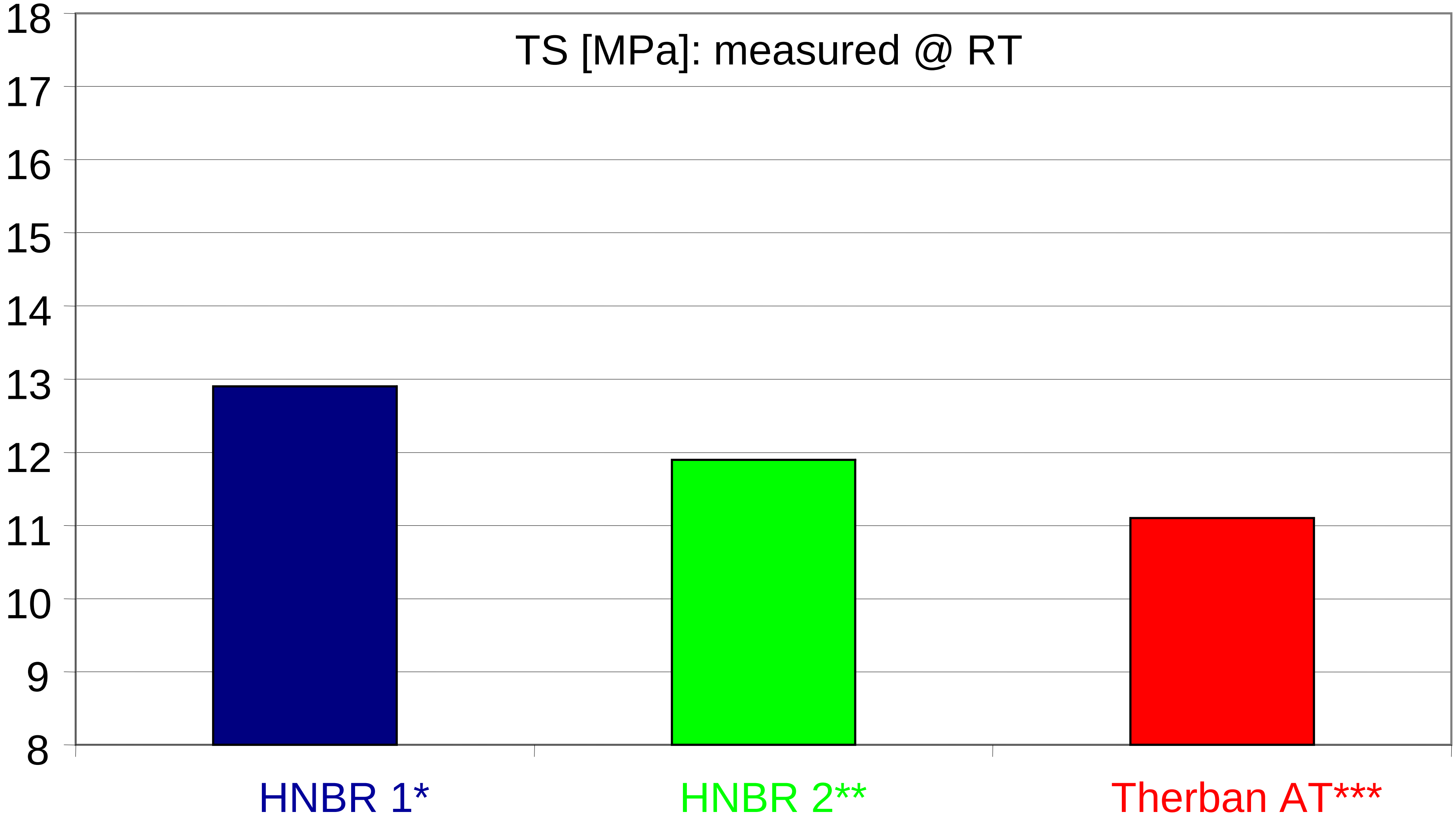
Tensile strength



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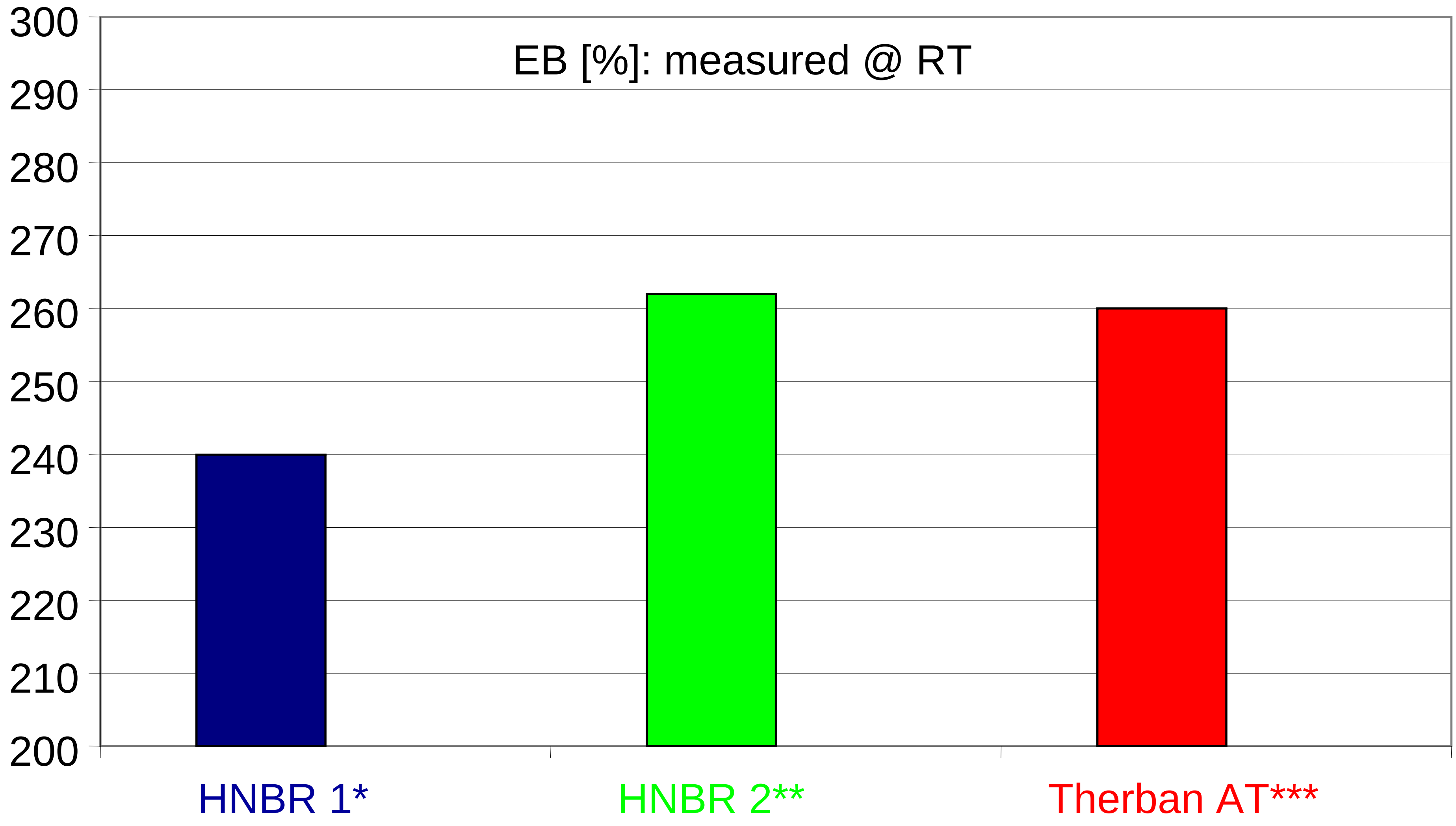
Elongation at break



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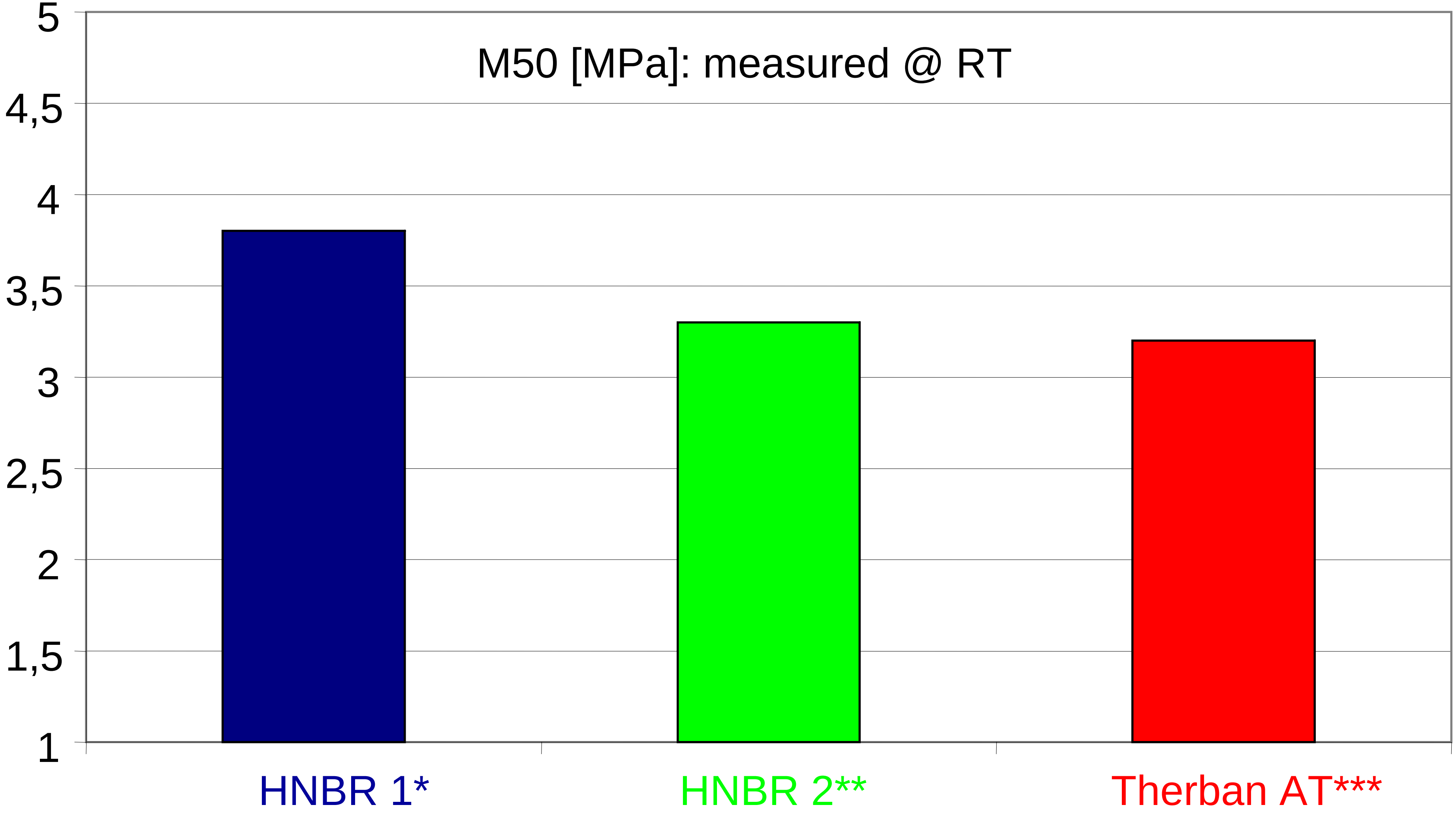
Modulus



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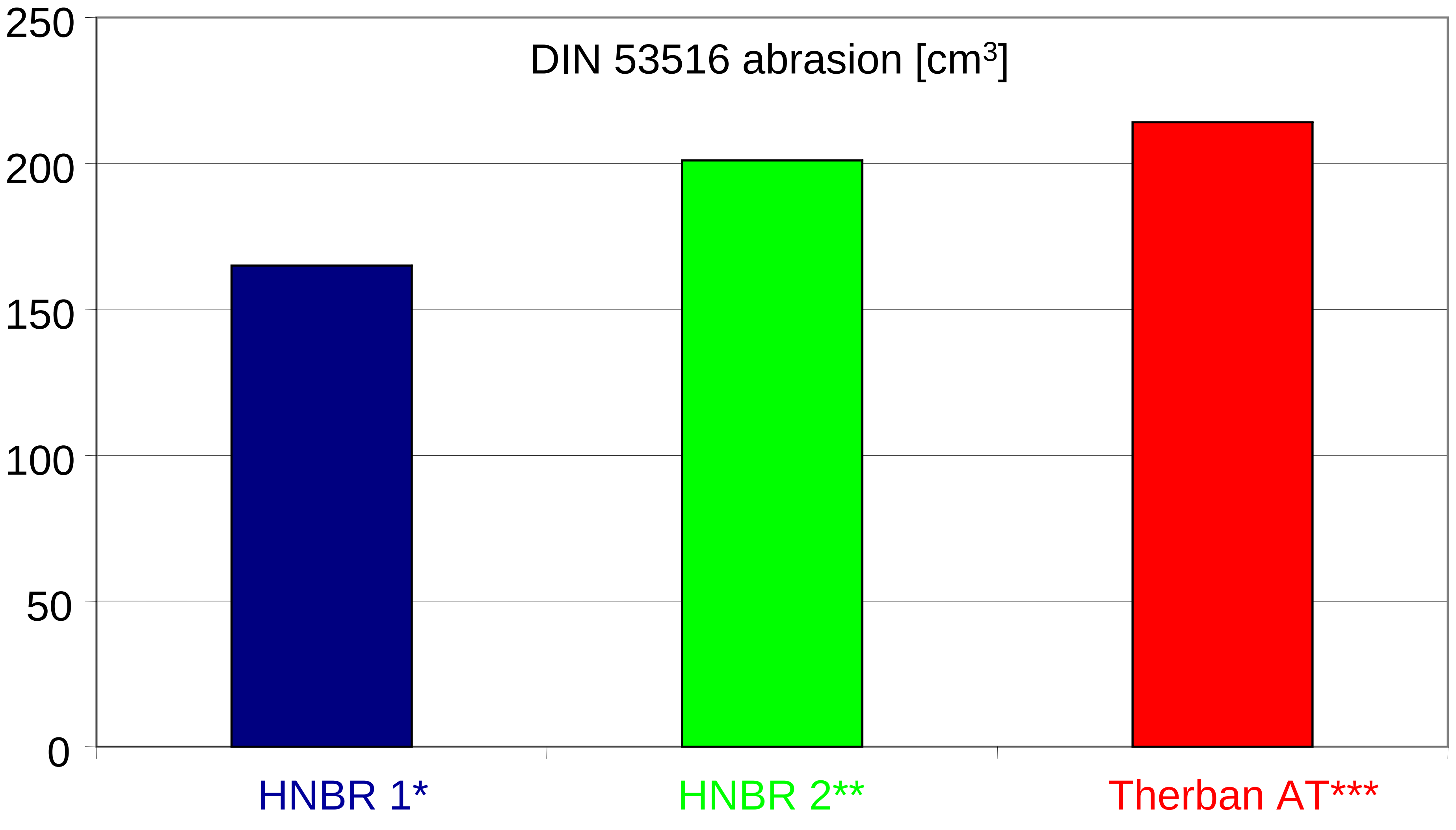
Abrasion



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