



New CABOT carbon blacks for various Tire applications

THEO AL, Cabot Corporation,

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CABOT

1) VULCAN® 1436

in

Truck Tire treads

THEO AL, Cabot Corporation

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Two key performance requirements

for Truck Tire Treads

- Enhanced Tread Wear Resistance - Increased Product Durability
- Reduced Rolling Resistance/Heat Build up - Better Fuel Economy and Improved Durability



Analytical Properties:

VULCAN 1436 vs. carbon blacks with “similar” surface area

Filler		STSA	OAN	Tint
Cabot Grade	ASTM	m ² /g	ml/100g	% ITRB
VULCAN 6	N220	105	114	115
VULCAN 1436		96	143	108
VULCAN J	N375	90	114	116
VULCAN M	N339	87	120	113

In comparison with other carbon blacks, VULCAN 1436 exhibits:

- Higher OAN structure
- Surface area in between VULCAN 6 and VULCAN J
- lower Tint



Basic properties at 50 phr in NR TT compound

	100% Mod	300% Mod	Tensile	El. @Break	Rebound		Shore Hardness	
	(MPa)	(MPa)	(MPa)	(%)	25°C	70°C	25°C	70°C
VULCAN 6	2,9	14,0	28,8	535	53	63	63	58
VULCAN J	3,2	16,0	29,8	505	55	66	63	58
VULCAN M	3,1	15,9	27,9	475	54	66	63	58
VULCAN 1436	3,8	18,6	30,8	470	56	68	65	61

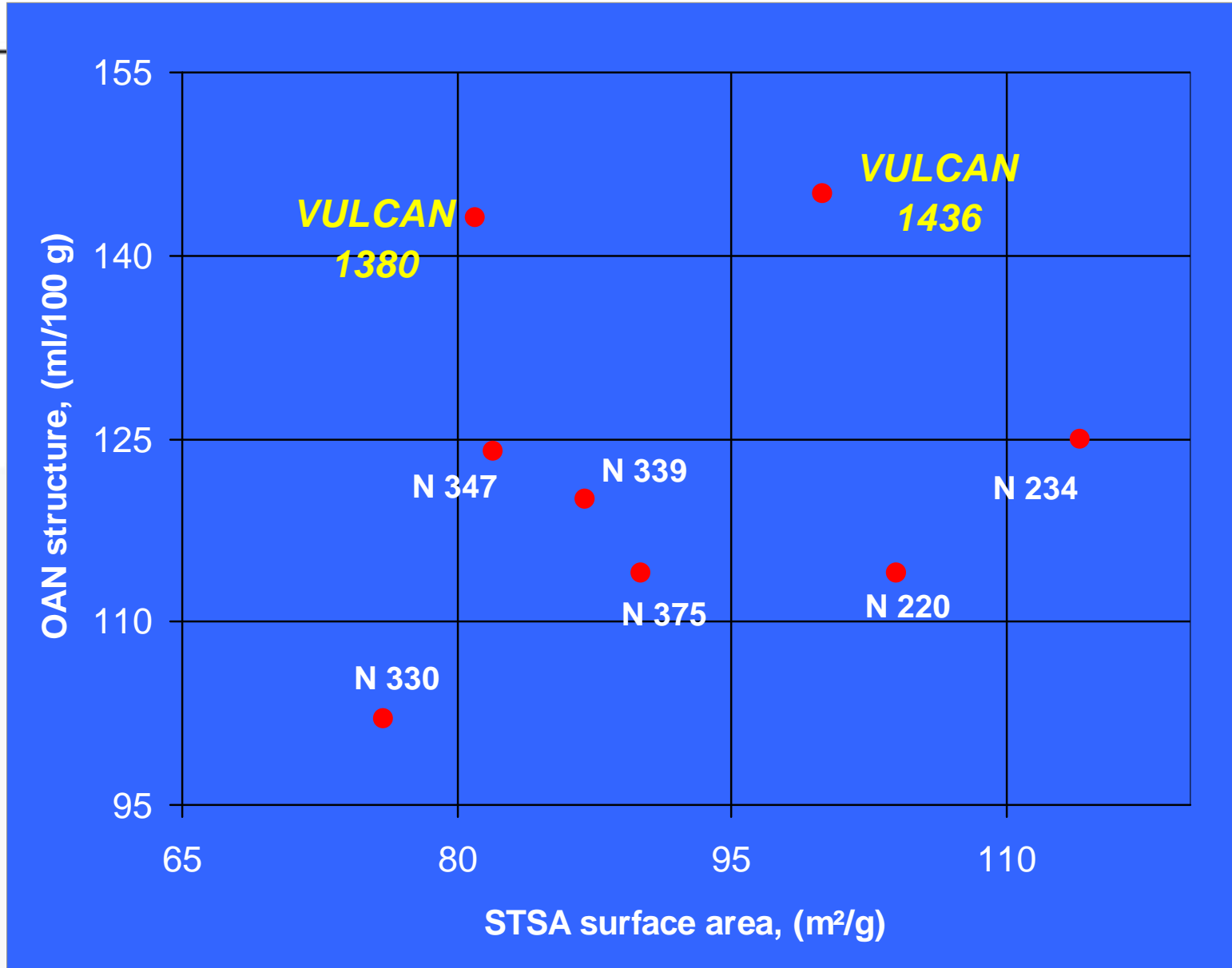
VULCAN 1436 based compounds exhibit in comparison with compounds based on VULCAN 6, VULCAN J and VULCAN M:

- Higher tensile modulus
- High Tensile Strength
- Higher Shore A hardness
- Higher rebound

So, VULCAN 1436 exhibits an excellent reinforcement capability

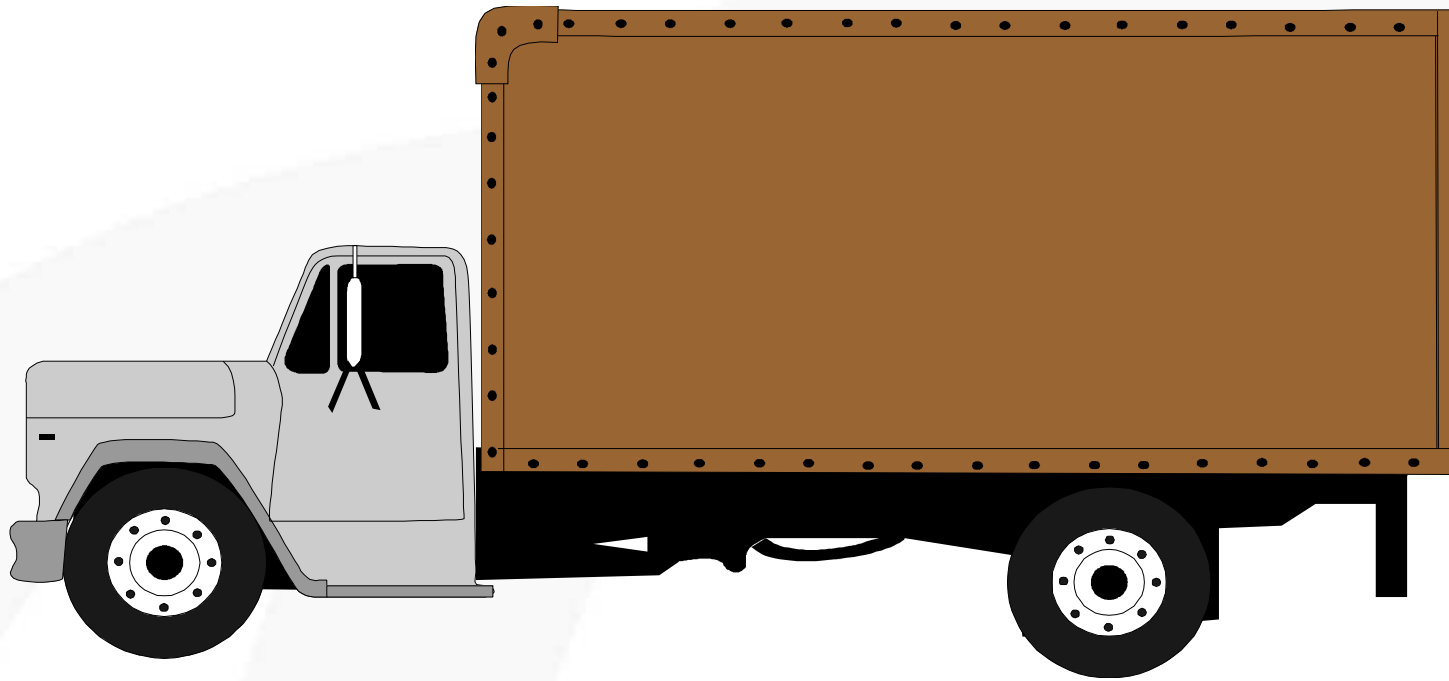


**Tread Wear & Heat
Build up in an NR / BR
truck tread formulation
(“Road Test”).**



Vehicles used

A) Rigid Vehicle



Drive axle:
'low' severity

Vehicles used continued

B) Tipper Unit, On / Off Road



4th axle:
'high'
severity

3th axle:
'medium' severity

Tread Wear data

Low severity after 55300 km	Wear (mm/1000 km)	Relative (higher = better)
VULCAN 6	0,1187	100
VULCAN 1380	0,129	92
VULCAN 1436	0,1176	101

Medium severity after 40700 km	Wear (mm/1000 km)	Relative (higher = better)
VULCAN 6	0,3369	100
VULCAN 1380	0,3584	94
VULCAN 1436	0,3336	101

High severity after 22700 km	Wear (mm/1000 km)	Relative (higher = better)
VULCAN 6	0,5401	100
VULCAN 1380	0,5685	95
VULCAN 1436	0,5511	98

Rolling Resistance and

Heat Build Up data

Heat Build Up	Average °C	Relative (higher = better)
VULCAN 6	78,4	100
VULCAN 1380	71,4	110
VULCAN 1436	74,1	106

Rolling Resistance	Coefficient	Relative (higher = better)
VULCAN 6	0,732	100
VULCAN 1380	0,622	118
VULCAN 1436	0,670	109

Conclusion Truck Tire Road Test

- VULCAN® 1436 offers an excellent compromise between heat build up (HBU), rolling resistance and tread wear resistance at all severities.



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**2) New CABOT Carbon
Blacks for
very High Performance
passenger tire treads**

Theo AI, Cabot Corporation

Intro

- The tread part of the tires for the very High Performance tire market segment requires a performance balance which are not typically met with the traditional high surface area ASTM carbon black grades.
- Typically, very high performance tire tread carbon blacks have a very fine particle size carbon black with a surface area much higher than the standard ASTM N200 and N100 types.
- Cabot has developed a family of very high surface area products, specifically for very high performance tire treads (> V rating).



Intro

- This presentation gives a brief overview and explanation about currently commercially available products like VULCAN® 1391 carbon black as well as new available CRX™ products for this special tire application.

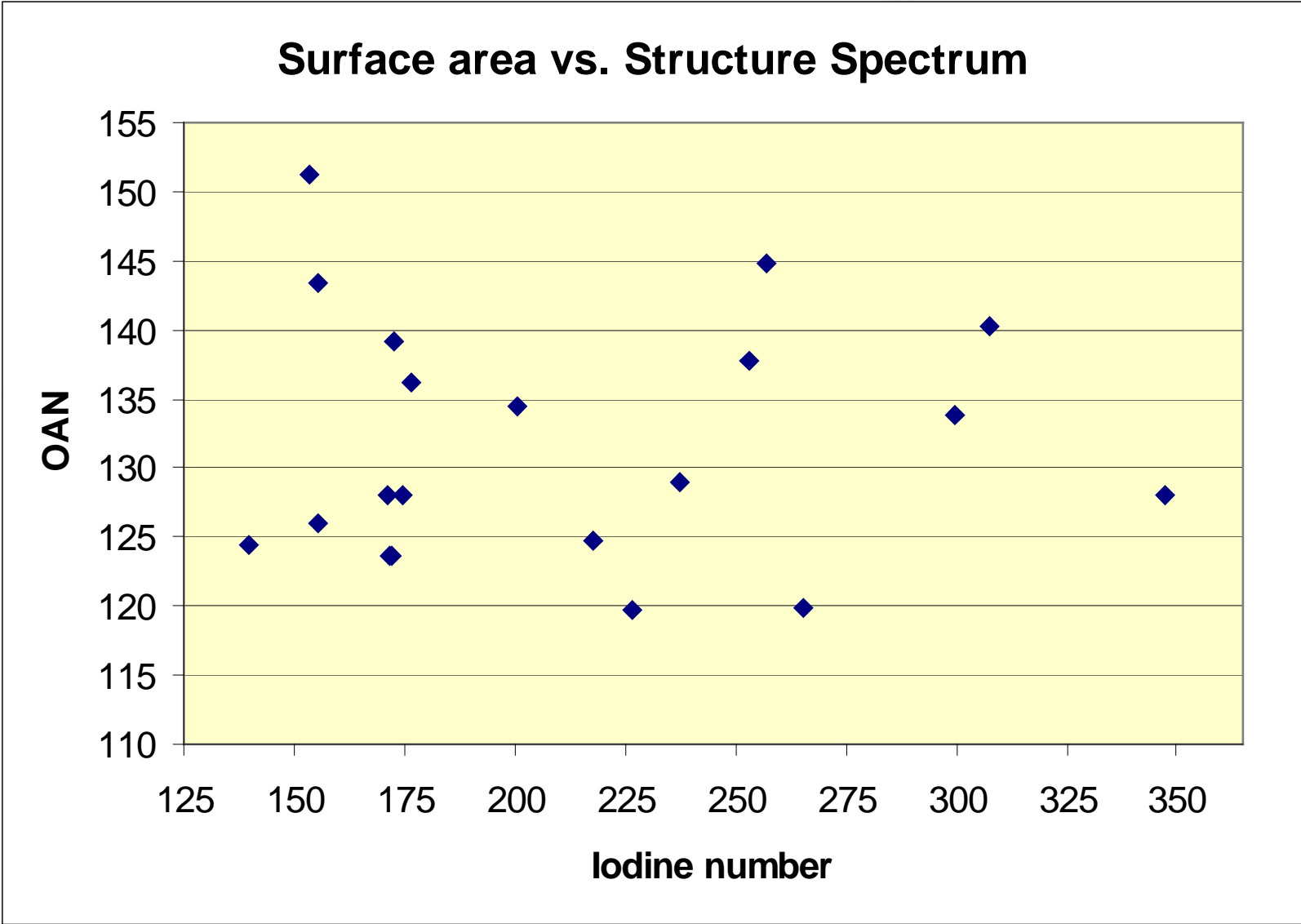
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CRX™ is a trademark of Cabot Corporation



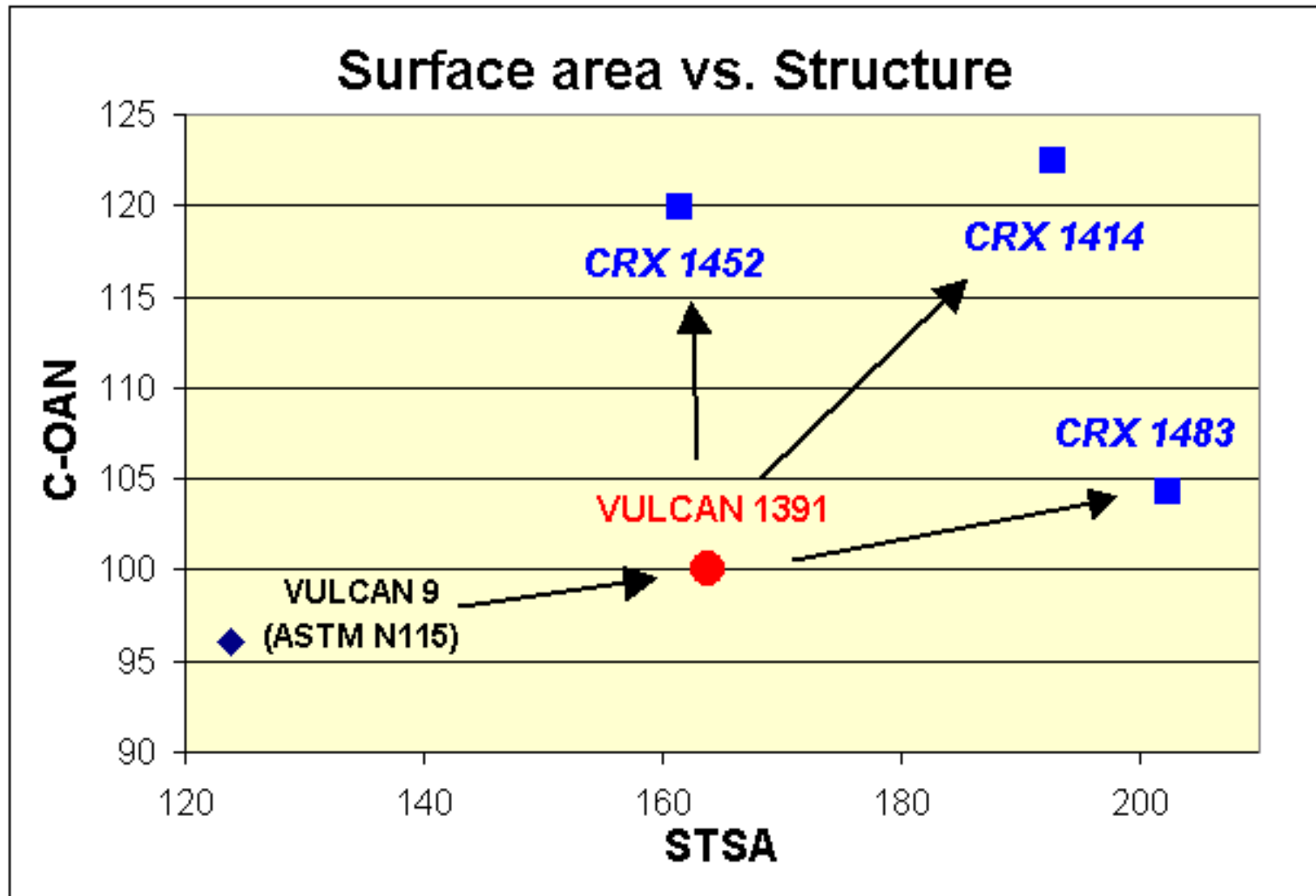
The key Very High Performance Tire criteria :

- Wet and Dry Traction
- High Speed durability, performance stability
- Wet and Dry Handling
- Aqua planing
- Although depending a bit on type, tread wear and rolling resistance are of less relevance

CABOT very HP tread carbon blacks



Let's focus on a few family members:



VULCAN 1391

88 phr compound results:

MDR @ 160°C, 1°arc

Min Torque (dNm)	4,9
Max Torque (dNm)	16,8
Scorch 1 (m.m.)	3,8
Scorch 3 (m.m.)	5,6
Scorch 5 (m.m.)	6,4
T50 (m.m.)	6,7
T90 (m.m.)	9,7

Mooney Viscosity

ML(1+4)@100°C (M.U.)	74
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Mooney Scorch @135°C

T3 (m.m.)	11,2
T10 (m.m.)	22,4
T18 (m.m.)	25,2

Crescent Tear

Tear Strength (N/mm)	61
Tear Energy (J)	24

Zwick Rebound

@ 23°C, (%)	15
@ 60°C, (%)	21

Tensile properties

Tensile Strength (MPa)	14,0
Elongation @ Break (%)	825
100% Modulus (MPa)	1,2
200% Modulus (MPa)	1,8
300% Modulus (MPa)	3,0

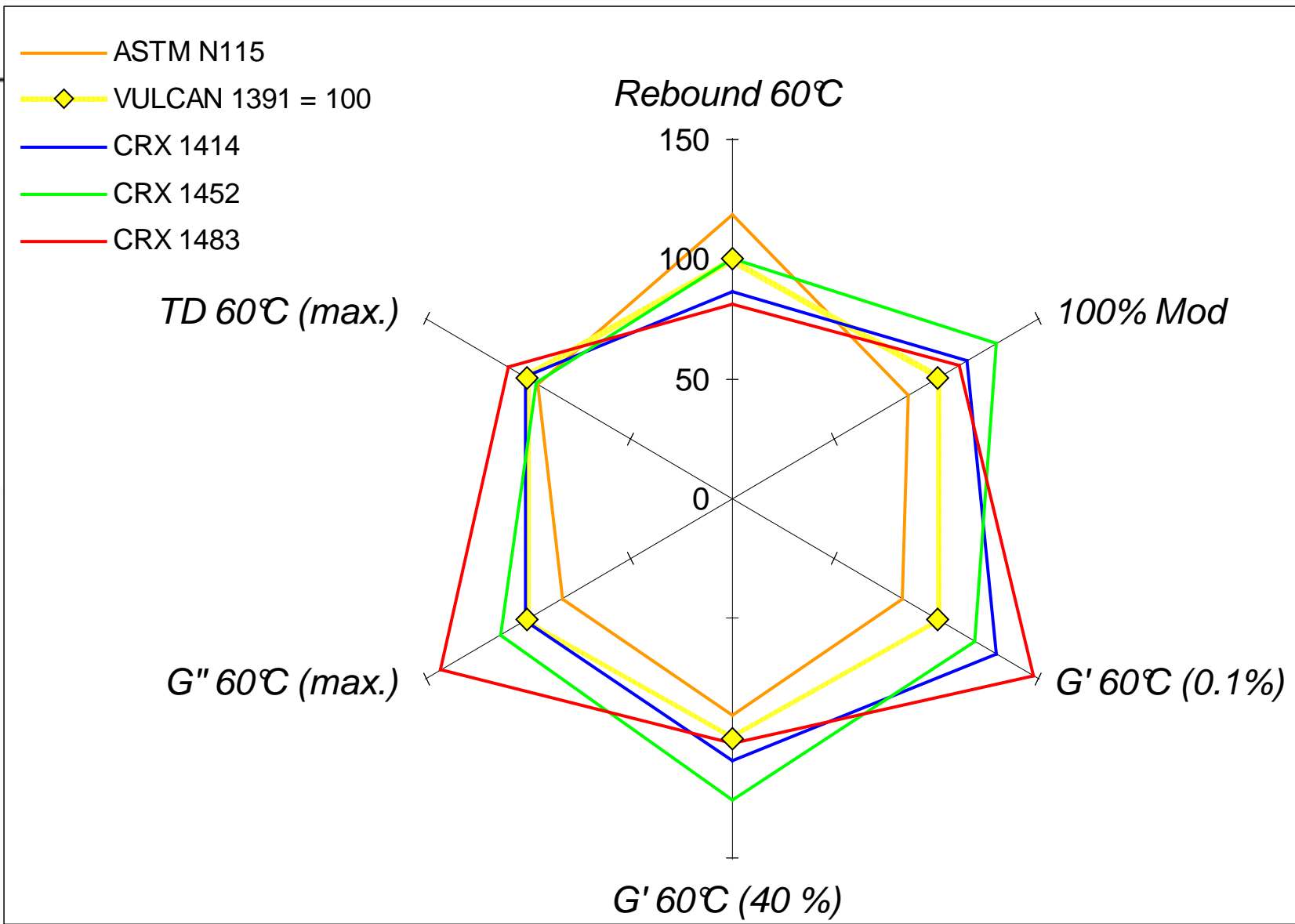
Hardness

Shore A, (3 sec.)	65
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Rheometrics Strain Sweep @60°C, 1 Hz

Tan Delta Max	0,505
G" Max (MPa)	2,01
G' (0.1%) (MPa)	9,32
G' (40%) (MPa)	0,81





Conclusion

- The new family of Cabot very high performance tire carbon blacks are a strong tool to better balance/ improve key rubber compound properties for very high performance tire tread applications
- Test data of only a few CRX carbon blacks have been shown. But the choice in available products offers a tailor made solution for very specific demands by customer in this application area



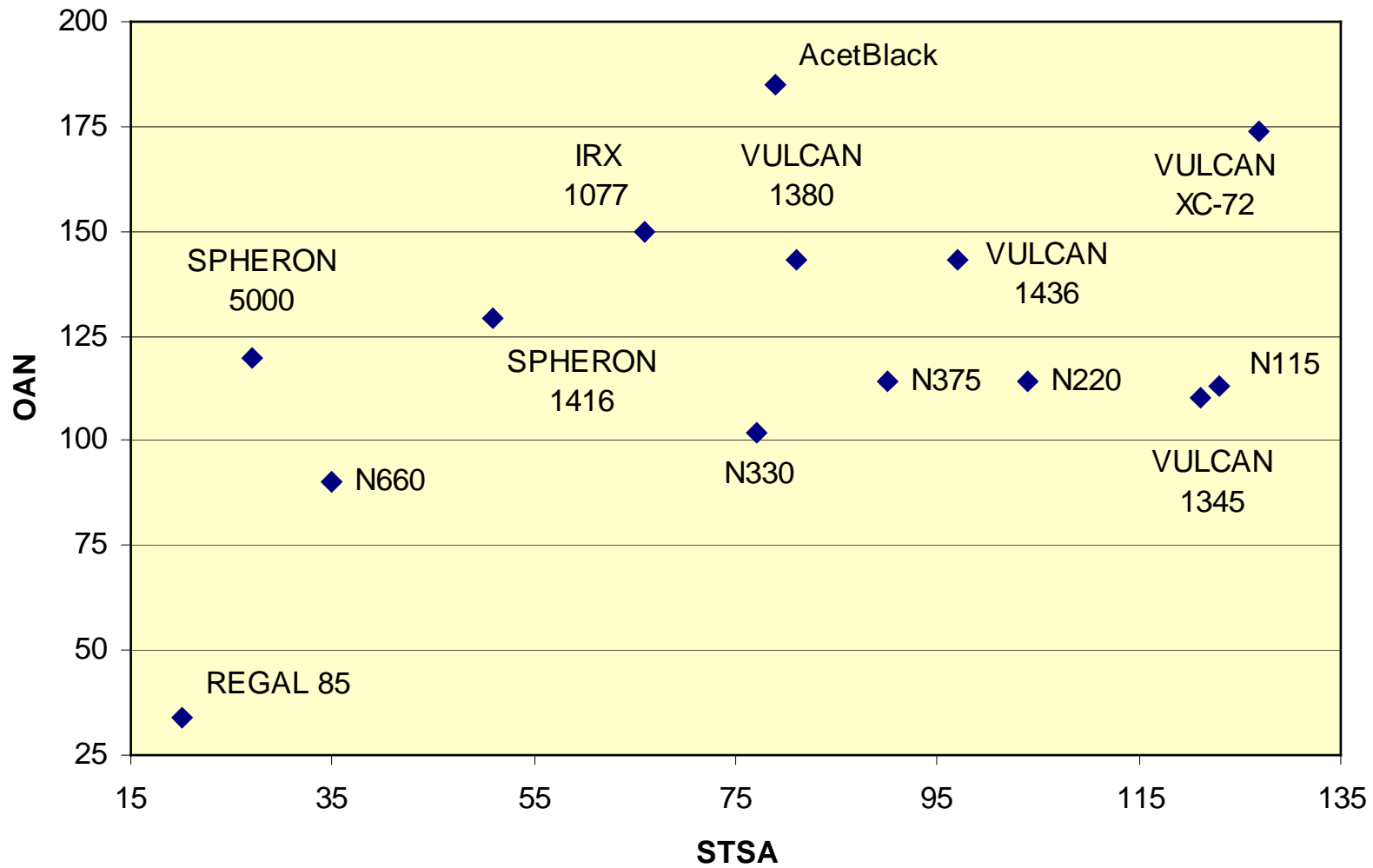
3) Various Carbon Blacks in Tire curing bladders

Theo AI, Cabot Corporation

Intro

- The carbon black choice for Tire curing bladder rubber compounding: standard ASTM N300 and N200 series carbon blacks + higher cost types like acetylene carbon blacks
- The choice of carbon black can strongly affect the balance between properties like compound costs, bladder life and thermal conductivity in tire curing bladder applications.
- This presentation shows a comparison between a range of standard and speciality carbon black grades in a resin cured butyl bladder test compound.
- All carbon blacks are compounded at equal hardness and a conclusion is made about which carbon black can offer the optimum balance in the Critical to Quality parameters for tire curing bladders.

STSA surface area vs. OAN Structure



Formulation and Carbon Blacks

<u>Ingredient</u>	<u>PHR</u>
BUTYL 268	100
CASTOR OIL	5
ZINC OXIDE	5
CARBON BLACK	See Table
CHLOROPRENE, (45 Mooney, mercaptan mod.)	5
ALKYL PHENOL formaldehyde resin	10

<u>Carbon Black</u>	<u>PHR</u>	<u>Carbon Black</u>	<u>PHR</u>	<u>Carbon Black</u>	<u>PHR</u>	<u>Carbon Black</u>	<u>PHR</u>
N330	50	VULCAN® 1436	43	N330/N660	25/30	SPHERON® 1416	50
N375	43	VULCAN 1380	43			N330/SPHERON 5000	25/30
N220	46	VULCAN 1345	43			REGAL 85	100
N115	43						
AcetBlack	54	VULCAN XC-72	46				
AcetBlack/N330	27/25	IRX™ 1077	46				

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VULCAN 3 ('N330')

50 phr compound results:

MDR @ 180°C

Min, (dNm)	4,3
Max, (dNm)	20,7
T50, (m:m)	13,8
T90, (m:m)	39,0

Mooney Viscosity @ 100°C

ML(1+4), (M.U.)	77
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Mooney Scorch @ 160°C

T5, (m.m.)	9,4
T10, (m.m.)	14,2

Hardness

Shore A (3 sec.)	62
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Thermal Conductivity

Ks, (W/mK)	0,217
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Tensile properties

Tensile Strength, (MPa)	14,8
Elongation @ Break, (%)	687
50% Modulus, (MPa)	1,5
100% Modulus, (MPa)	2,2
200% Modulus, (MPa)	3,9
300% Modulus, (MPa)	6,3

Crescent Tear

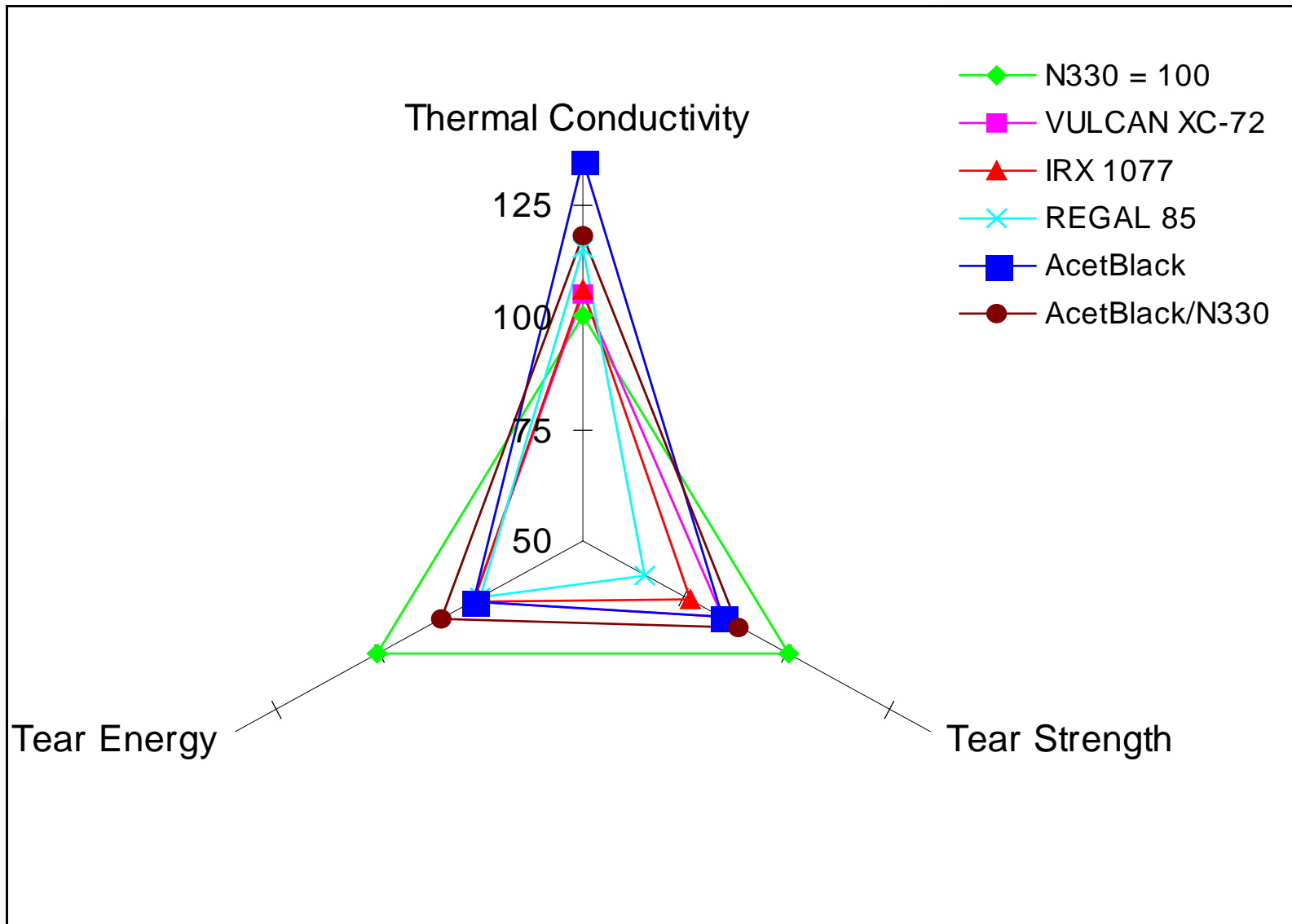
Tear Strength, (N/mm)	49
Tear Energy, (J)	13

Fatigue

total best 10 out of 11 (x E06)	6,0
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Thermal conductivity as basis:



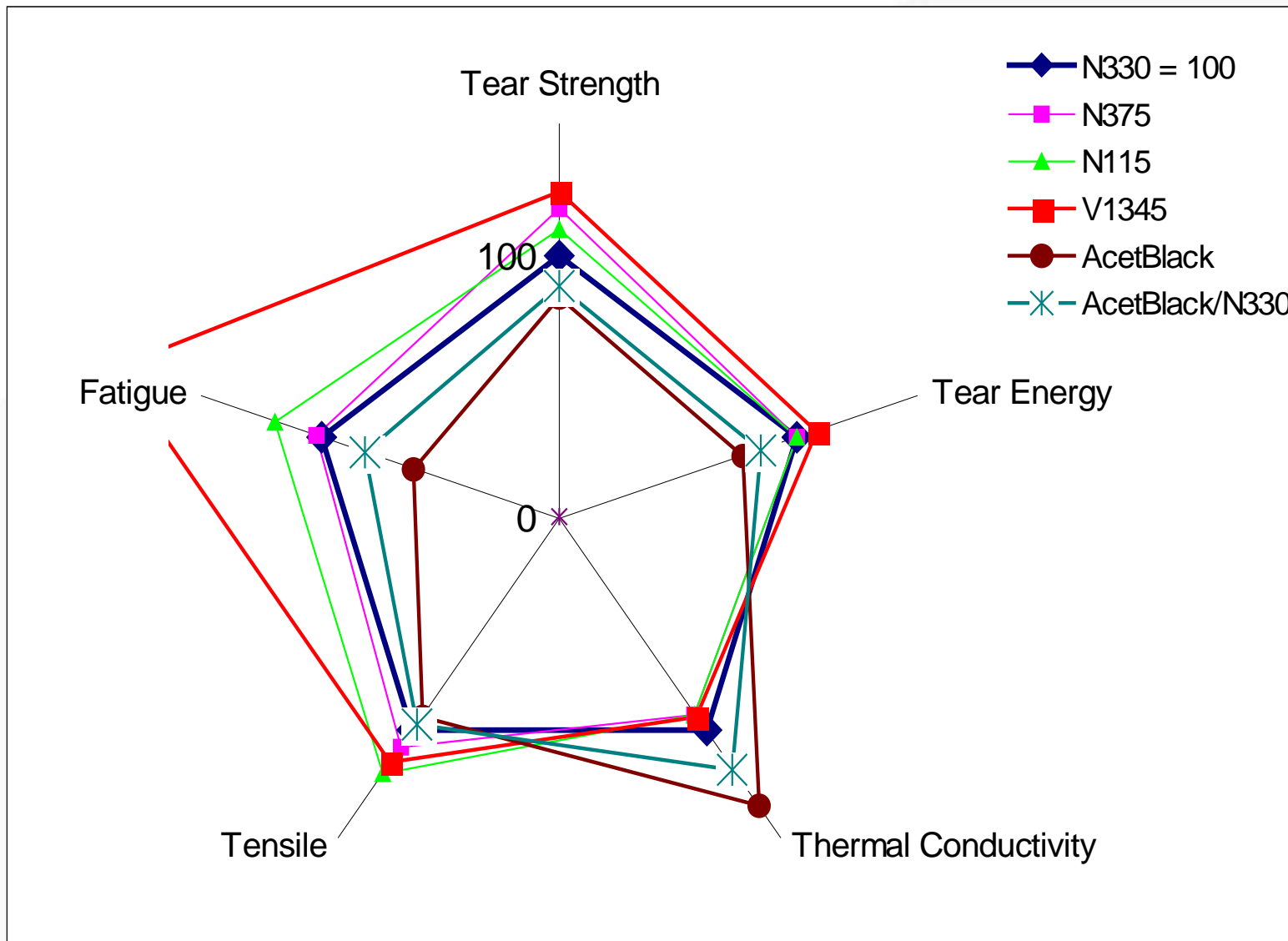
But how important is thermal

conductivity really for curing bladders ?

- Is in reality the thermal conductivity of the tire compound(s) not the limiting factor instead of the bladder ?

====> would paying more attention on optimizing Tear/Fatigue to enhance bladder life not be a more important saving and performance enhancing area for curing bladders ?

Let's focus more on Bladder Life:



Conclusion

- Thermal conductivity of acetylene carbon black can not easily be met with furnace carbon blacks. Considerable re-compounding by increasing carbon black + plasticizer content would be needed. But how important Critical to Quality parameter is that really ?
- Bladder life of compounds based on acetylene carbon black, ASTM N300 and N200 series carbon black can be drastically improved with VULCAN 1345

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