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The Power of Rubber Recycling

Website: www.levgum.com

Test Reports

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Abstract

This document consolidates test reports on various types of DRC (De-vulcanized Rubber Compound), produced by the Levgum process and inserted at different percentage by weight into virgin compounds.

The document is organized by rubber type of the virgin compound into which the DRC was inserted.
This is to demonstrate that the Levgum's DRC can be made from all Sulphur cured rubber, as well as, be inserted into any Sulphur cured virgin rubber.
To that end we have shown the use of NR based DRC in NR based virgin compounds in the first chapter of the document.
The second chapter shows how the use of NR based DRC in an SBR-NR virgin compound can improve Tensile Strength (TS) and Elongation at Break (EB).
In the third chapter we show the good results of EPDM based DRC embedded in an EPDM virgin compound up to 90% by weight.
The fourth chapter discusses a new form of DRC. DRC in sheets with a binding material. Together with our Indian licensee Sundaram Industries Privet Limited (SIPL) we have developed a sheet form to DRC called SILSHEET (DRC with a binder to make it into sheet format). It is shown to have high quality better than any competitor commercially available in the market.
Last chapter covers the Nitril Rubber. We have made Nitril based DRC and used it in a Nitril based virgin compound for Pipes. These results were obtained by an end user. Unfortunately, he allows us to disclose the results but not his name.

On this it is important to note that using the proper type of DRC, namely, DRC originating from a certain polymer-based compound, may, under certain circumstances, even cause an improvement of the resulting compound. For example, using DRC originating from NR based compounds such as those coming from OTR and truck ELT (End of Life Tyres), in an SBR based virgin compound, will improve EB (Elongation at Break) and TS (Tensile Strength). The explanation is as follows: NR based compounds are having better elongation at break and tensile strength than SBR based compounds. The difference might be large enough that DRC made of NR would still poses better EB and TS than virgin SBR based compound. Hence, when embedded in such a compound it will improve its EB and TS.
This is but one example to how innovative and creative compounding may cause improvement while lowering the cost of the overall compound. Simply by using the right DRC for the job of elevating the properties one wishes to improve.

The results also demonstrate how changing the acceleration may change some of the properties of the compound (sometime at the expense of other properties).

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Levgum has more results to show. Some originating from leading tyer manufacturers. However, these may be shown but not distributed under current NDAs.

NR based virgin compounds

DIK: (https://www.dikautschuk.de/en/)
Deutsches Institute fur Kautschuktechnologie e.V. is the leading German laboratory for rubber. The report was commissioned and paid for by Omnigal when testing Levgum's technology.

DIK

Deutsches Institut für Kautschuktechnologie e. V.

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T E S T R E P O R T

"Physical Characterization of
Recycled Rubber Compound (RRC)"
DIK order no.: 05V0188

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DIK Objectives

OmniGal Int. produced "Recycled Rubber Compound (RRC)" made of cured rubber supplied by DIK. The objective was to compare the physical properties of three samples one virgin compound and two compounds which contain different concentrations of RRC.

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Test methodology

- Natural rubber compound ,standard formulation for truck tires, was mixed and cured in the DIK.
- The cured material was Recycled by OmniGal and RRC sent back DIK.
- Compounds were prepared by incorporating two different concentration of RRC 15 and 25 % by weight.
- These three compounds have been characterized physically as follows:
  - Curing properties at 160 °C (DIN 53529)
  - Mooney Viskosity ML (1+4) at 100 °C (DIN 53523)
  - Hardness Shore A (DIN 53505)
  - Rebound resilience (DIN 53512 ,d = 12,6 mm)
  - Stress strain properties (DIN 53504)
  - Abrasion (DIN 53516)

DIK's Formula for Truck Tires

• Natural rubber	59.1 %
• Carbon black (Type N 115)	29.6 %
• Zinc oxide	2.4 %
• Stearic acid	1.2 %
• 6PPD (Antioxidant)	1.2 %
• TMQ (Antioxidant)	1.2 %
• Paraffinic wax	0.9 %
• Aromatic oil	2.4 %
• Sulphur	1.0 %
• CBS (Curing accelerator)	1.0 %

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Test results

	Reference	Sample A	Sample B
RRC concentration (% by weight)	*0*	*15*	*25*
Rheometer at 160 °C			
Min. torque (dNm)	3,58	2,62	3,15
Max. torque (dNm)	19,91	18,94	19,15
Δ torque (dNm)	16,33	16,32	16,00
TC90 (Minutes)	4,04	3,03	2,59
ML (1+4), 100 °C (MU)	31	51	58
Hardness Shore A	65,6 ± 0,2	63,9 ± 0,2	65,2 ± 0,3
Tensile strength (MPa)	30,8 ± 1,4	27,3 ± 0,8	26,6 ± 1,3
Elongation at break (%)	548 ± 17	535 ±12	487 ± 19
Modulus at 50 % elongation (MPa)	1,5 ± 0,1	1,3 ± 0,0	1,4 ± 0,0
Modulus at 100 % elongation (MPa)	2,6 ±0,1	2,2 ± 0,0	2,4 ± 0,0
Modulus at 200 % elongation (MPa)	6,8 ± 0,1	5,7 ± 0,0	6,1 ± 0,1
Modulus at 300 % elongation (MPa)	12,7 ±0,3	11,0 ± 0,1	12,1 ± 0,2
Rebound resilience (%)	45,8 ±0,4	40,7 ± 0,4	41,8 ± 0,5
Abrasion (mm^3) *	108 ± 2	130 ± 5	132 ± 4

Conclusions

- The mooney viscosity of both RRC comp. is higher But at values of 51 respectively 58 mooney units at 100 °C we do not expect any processing problems caused by the viscosity .
- The curing behavior of the RRC comp. is very similar to that of the virgin comp.
- Curing speed is faster whit RRC, torque is nearly the same.
- The Shore A hardness of the three samples meet the same area.
- Tensile properties tend to lower when RRC is used. But it's doubtful whether the detected differences in properties are significant with the sense of a statistic evaluation.
- The rebound test gives a higher elasticity for the virgin comp .
- Abrasion loss of both RRC comp. is higher.

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NR corrected acceleration

Duram (http://www.duram.co.il/) is an Israeli firm producing injected molded rubber products. It has one of Israel most professional rubber laboratories and rent services of testing. Levgum has worked with them from the start and benefited much from their knowledge.

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M.B. M-90 (Duram)+Devulcanized NR compound
Corrected acceleration

CODE / ingredients		M-90 Duram		M-90 / Devulcanized 85/15	75/25	50/50	30/70	Corrected acceleration A	B
SMR CV60	MASTER BATCH	100.00							
			M.B. M-90	85.00	75.00	50.00	30.00	50.00	
Carbon Black		42.00							
			devulc. NR	15.00	25.00	50.00	70.00	50.00	
Zno		2.40							
			Zno	0.26	0.43	0.88	1.20	0.88	
Stearic acid		1.50							
			Stearine	0.18	0.30	0.60	0.80	0.60	
Flectol TMQ		1.00							
6PPD		1.00							
Struktol A-60		1.50							
TOTAL		149.40		100.44	100.73	101.48	102.00	101.48	
Sulfur	ACCELERATION	1.60	Sulfur	1.00	1.00	1.00	1.00	0.60	0.80
TMTM		0.05	MBS	0.50	0.50	0.50	0.50	0.60	0.70
DTDM 80%		0.22	DTDM					0.80	
CBC		0.63							
Struktol A-60		0.50	PVI						0.10
ML	Reometer MDR 2000 160 C	1.95		2.17	2.37	2.86	3.51	2.85	3.02
MH		14.84		13.29	13.70	14.43	14.26	14.59	13.50
TS2		2.50		1.58	1.34	0.87	0.65	1.29	1.17
T50		3.17		2.48	2.06	1.37	1.03	1.70	1.66
T90		4.82		4.66	3.89	2.64	2.05	2.62	2.81
0 / + Hardness Shore A		60		61	62	63	63	62.5	61.5
0 / + 100	Modulus kg/cm²	28		22	22	25	29	25	22
0 / + 200		62		55	54	63	74	62	55
0 / + 300		120		107	107	125	148	122	109
0 / + Tensile strength kg/cm²		289		257	250	238	224	239	240
0 / + Elongation %		548		538	503	445	387	448	479
COMP. SET									
SPCIFIC GRAVITY S.G.		1.087		1.095	1.100	1.111	1.120	1.111	1.111
ABRASION RESISTANCE - ML		123		136	135	145	149		
TEAR STREANGTH TROUSERS DIE kg/cm		18.8		16.1	16.2	9.0	7.9		

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LAB MANAGER

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SBR NR blend corrected acceleration

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M.B. NR/SBR blend (client M.B.)

code Devlc. % / Ingredients			M.B. Formula according to the client		10%	20%	30%
Master Batch (%)			182.00 (100)		163.8 (90)	145.6 (80)	127.4 (70)
Master batch	NR		62.00				
	SBR		38.00				
	C. Black		69.00				
	Regenerat		5.50				
	Chemicals		7.50				
	D R C. - Devulcanized		(0)		18.2 (10)	36.4 (20)	54.6 (30)
	ZnO		-		0.40	0.80	1.20
	Stearic acid				0.20	0.40	0.60
Total			182.00		182.60	183.20	183.80
Accelerators	Sulfur		1.00	1.50	1.00	1.00	1.00
	CBS		1.50	0.8	1.50	1.50	1.50
	TMTM					0.40	0.40
	DTDM 80%						
	TMTD		1.00	1.00	1.00	0.60	0.60
	Struktol A-60					0.60	1.00
	Total						
Rheometer MDR 2000 160° C		ML	1.70	1.77	2.13	2.57	3.12
		MH	16.40	18.63	16.71	15.37	15.16
		TS	3.03	2.42	2.37	2.19	1.86
		T50	3.81	3.15	2.96	2.64	2.22
		T90	5.68	5.29	4.67	4.33	3.87
Hardness (1) 0 (2) +			61	63.0	61.0	60.0	60.0
Modulus kg/cm²	100%	0		28	21	19	19
		+					
	200%	0		74	56	46	48
		+					
	300%	0		126	103	90	95
		+					
Tensile strength		0		141	139	129	133
		+					
Elongation %		0		329	385	382	381
		+					
Tear resistance kg/cm Trouseres				6	8.20	8.80	8.80
ABRASION RESISTANCE - mm³				90	95	96	110
Compression set % 22hs, 70°C							
S.G.	calculated						
	measured			1.128	1.124	1.128	1.131

ORR made of NR Productuion waste Performance Data Sheet

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EPDM corrected acceleration

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DATE: 08/01/2004 COMPOUND: **M.B. EPDM (Duram)+Devulcanized EPDM**
Corrected acceleration

	CODE / ingredients		E-60 Duram			Duram E-60 / devulcanized EPDM 90/10	70/30	50/50	Corrected acceleration A	
MASTER BATCH					M.B. E-60	90.00	70.00	50.00	50.00	
					devulc. EPDM	10.00	30.00	50.00	50.00	
					Zno		0.40	0.60	0.60	
					Stearine		0.12	0.20	0.20	
TOTAL			256.50			100.00	100.52	100.80	100.80	
ACCELERATION	Sulfur		1.40			0.56	0.56	0.56	0.56	
	CBS		1.60			0.64	0.64	0.64	0.80	
	MBTS		0.70			0.28	0.28	0.28	0.10	
	MBT 80%		0.24			0.10	0.10	0.10	TMTM 0.10	
	TMTD		0.70			0.28	0.28	0.28		
	Sruktol A-60		1.10							
Rheometer MDR 2000 170 C	ML		1.84			1.88	2.35	3.00	2.81	
	MH		15.10			15.88	15.32	14.93	14.11	
	TS2		1.56			1.23	0.95	0.86	0.99	
	T50		2.12			1.65	1.30	1.20	1.39	
	T90		3.51			3.08	2.97	3.80	3.87	
HARDNESS Shore A		0	60			61	64	64		
		+	62			63	66	67		
Modulus kg/cm²	100	0	29			26	29	31		
		+	36			36	39	41		
	200	0	54			52	59	68		
		+	64			65	78	86		
	300	0	73			74	89	107		
		+	93							
Tensile strength kg/cm²		0	96			104	108	110		
		+	95			94	104	120		
Elongation %		0	369			376	346	307		
		+	307			287	256	264		
COMP. SET										
S.G.	SPCIFIC GRAVITY		1.076			1.074	1.102	1.119		
ABRASION RESISTANCE - ML										
TEAR STREANGTH TROUSERS DIE kg/cm										

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IS ISO 9001
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ARDL (Akron Rubber Development Laboratory)

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ARDL (https://www.ardl.com/) is considered to be one if not the leading rubber laboratory in the US. It was choosen by Dr. Grady as well as the testing protocol. He based his letter (see next) on this report. The work was paid for by Mr. Galiga who also hired Dr Grady, not by Levgum.

"Progress Through Innovation, Technology and Customer Satisfaction"

ARDL

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Website: www.ardl.com • E-mail: info@ardl.com

March 15, 2007

• TEST REPORT •

PN 70671

Physical Testing Department

Prepared For:

Mr. Ran Zamir
Levgum LTD
26 Adom Street
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Prepared By: Bob May
Bob May
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ISO 9001:2000
Registered

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Member of ACIL: The American Council of Independent Laboratories

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March 15, 2007

PN 70671

Mr. Ran Zamir
Levgum

SUBJECT: Evaluation of Reclaim EPDM Rubber in an EPDM Formulation.

RECEIVED: Approximately 18 lbs of ground reclaim EPDM from Levgum.

NO HOLD MASTER BATCH, BANBURY MIXED

1. 3 Batches MB mixed 3-5-07
2. Finals Mixed 3-5-07/No Hold
3. Rheometer 3-5-07/No Hold
4. Curing 3-5-07/No Hold
5. Physicals 3-6-07/No Hold

CURING DATA, ASTM D 3182

PHASE II Test Plaque MB no hold	ORIGINAL	20%	50%	90%
Cure Time, minutes	35	35	35	35
Cure Temperature, degrees	308	308	308	308

RHEOMETER DATA, ASTM D 2084

Tech Pro rheo Tech ODR
308 degrees F, 3 degrees arc, 60 min. chart speed, 100 inch lbs., 100 cpm.

	ORIGINAL	20%	50%	90%
Maximum Torque, MH, lbf inch	76.73	86.69	83.10	83.94
Minimum Torque, ML, lbf inc	12.38	14.81	23.39	46.39
Scorch Time, Ts2, minutes	4.87	8.80	7.37	7.83
Cure Time, Tc 50%, minutes	8.23	16.45	14.34	14.80
Cure Time, Tc 90%, minutes	29.47	38.01	44.88	51.77

ORIGINAL PHYSICAL PROPERTIES, ASTM D 412a(02)e1, D 2240

Die C cumbbells tested at 20 in/min.

	ORIGINAL	20%	50%	90%
Shore A Durometer, points	66	65	66	67
Tensile Strength, psi	1980	1920	1810	1550
Ultimate Elongate, %	400	370	330	270
100% Modulus, psi	204	360	370	390
200% Modulus, psi	334	840	890	990
300% Modulus, psi	1321	1420	1570	-

Mr. Ran Zamir
Levgum

48 Hour Hold Final/Cure
1. 3 Batches MB 3-5-07
2. Finals Mixed 3-5-07
3. Rheometers on 3-5-07
4. Curing on 3-7-07/48 Hr. hold
5. Physicals on 3-13-07

CURING DATA, ASTM D 3182
PHASE II Test Plaques

MB mixed 3-5 rested 48 hours	20%	50%	90%
Cure Time, minutes	35	35	35
Cure Temperature	308	308	308

RHEOMETER DATA, ASTM D 2084
Tech Pro rheo Tech ODR
308 degrees F, 3 degrees arc, 60 min. chart speed, 100 inch lbs., 100 cpm.

	ORIGINAL	20%	50%	90%
Maximum Torque, MH, lbf inch	76.73	86.69	83.10	83.94
Minimum Torque, ML, lbf inc	12.38	14.81	23.39	46.39
Scorch Time, Ts2, minutes	4.87	8.80	7.37	7.83
Cure Time, Tc 50%, minutes	8.23	16.45	14.34	14.80
Cure Time, Tc 90%, minutes	29.47	38.01	44.88	51.77

ORIGINAL PHYSICAL PROPERTIES, ASTM D 412a, D 2240
Die C dumbbells tested at 20 in/min.
MB 48 hour hold Tested 3-13

	20%	50%	90%
Shore A Durometer, points	68	67	69
Tensile Strength, psi	1915	1800	1363
Ultimate Elongate, %	385	344	245
50% Modulus, psi	211	215	233
100% Modulus, psi	347	358	384
200% Modulus, psi	808	864	962
300% Modulus, psi	1360	1513	-

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Mr. Ran Zamir
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3. 48 Hour Hold MB/Final
1. 3 Batches MB 3-5-07
2. Finals Mixed 3-7-07/48 Hold
3. Rheometers on 3-7-07
4. Cured on 3-7-07
5. Physicals 3-13-07

CURING DATA, ASTM D 3182
PHASE II Test Plaques

MB mixed 3-5 rested 48 hours	20%	50%	90%
Cure Time, minutes	35	35	35
Cure Temperature	308	308	308

RHEOMETER DATA, ASTM D 2084
Tech Pro rheo Tech ODR
308 degrees F, 3 degrees arc, 60 min. chart speed, 100 inch lbs., 100 cpm.
MB 48 hour hold (3-7)

	20%	50%	90%
Maximum Torque, MH, lbf inch	85.39	84.76	92.33
Minimum Torque, ML, lbf inch	14.21	22.83	44.57
Scorch Time, Ts2, minutes	8.66	7.35	6.46
Cure Time, Tc 50, minutes	15.92	14.36	13.76
Cure Time, Tc 90, minutes	34.97	42.97	46.49

ORIGINAL PHYSICAL PROPERTIES, ASTM D 412a, D 2240
Die C dumbbells tested at 20 in/min.
FINALMB 48 hour hold Tested -13

	20%	50%	90%
Shore A Durometer, points	68	68	68
Tensile Strength, psi	1713	1711	1546
Ultimate Elongate, %	345	319	275
50% Modulus, psi	212	219	221
100% Modulus, psi	349	365	362
200% Modulus, psi	825	886	917
300% Modulus, psi	1395	1551	-

Prepared By: Bob May
Bob May
Supervisor Compound Development
Mixing & Processing

Approved By: Mac Wilborn
Mac Wilborn
Vice President
Business Development Services

BM/MW/cvh

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Dr. Grady's report (based on the above ARDL results. Tests made under his instructions)

The University of Oklahoma

SCHOOL OF CHEMICAL, BIOLOGICAL AND MATERIALS ENGINEERING

April 12, 2007

Michael L. Galiga, Esq.
CEO
As One With The Environment, L.L.C.
3001 E. Memorial Rd.
Edmond, OK 73013

Dear Mr. Galiga,

I, Dr. Brian Grady, Professor in the School of Chemical, Biological and Materials Engineering at the University of Oklahoma, have completed my investigation into the technology, patented by Levgum Ltd., presented by your group regarding the process for devulcanization of rubber with the end product named Purus™ Rubber, powered by Levgum technology, as a filler in virgin rubber.

I strongly endorse this technology for the following reasons: The technology works. The technology has no drawbacks or hidden problems. The technology can be and has been put into industrial practice with few challenges and at a reasonable cost. The remainder of the letter describes the reasons for my very positive overall evaluation.

Does the technology work?

A great deal of data from a variety of worldwide sources shows that the process works very well. Mr. Galiga, CEO of As One With The Environment, asked me to verify the current data with a comprehensive test with a premier laboratory in America. Hence, I designed such a study and located such a laboratory. Mixing, aging and tensile tests were carried out by Akron

Rubber Development Laboratory (ARDL), which is a recognized leader in its field. The rubber was devulcanized by Levgum personnel. EPDM rubber was used for the tests. Briefly stated, the following steps were undertaken:

a) Rubber was mixed and cured using a standard formulation. No antioxidant was used in order to shorten heat aging tests.
b) A portion of the rubber was tested using tensile and heat aging tests.
c) The remainder of the rubber was made into crumb and devulcanized.
d) The devulcanized rubber crumb (Purus™ Rubber, powered by Levgum technology,) was mixed with the uncured rubber of the same general formulation and cured.
e) Purus™ Rubber, powered by Levgum technology, substitution levels of 20%, 50%, and 90% were tested.
f) The tensile strength and elongation at break dropped approximately 5%, 10% and 15% respectively, which is outstanding performance.
g) There was no statistically significant difference in heat aging behavior between the material with and without Purus™ Rubber, powered by Levgum technology,.

Simply stated, the performance of Purus™ Rubber, powered by Levgum technology, is excellent.

100 East Boyd, T-335, Sarkeys Energy Center, Norman, Oklahoma USA 73019-1004
PHONE (405) 325-5811 FAX: (405) 325-5813

Does the technology have any drawbacks or hidden technological problems?

Environmental Stability

Data indicates that with the appropriate chemicals, material containing Purus™ Rubber, powered by Levgum technology, will behave identical to material with 100% virgin rubber with respect to environmental resistance (heat, water etc). The aging property of the rubber tested by others simulated up to 25 years of outdoor use with good results.

Cure Time
In our tests, the cure time was about 50% slower than the cure time of the 100% virgin rubber. The reason for the difference is that it is difficult to predict how accelerators/curing agents have to be adjusted with the Purus™ Rubber, powered by Levgum technology, to match the cure times. It would be a simple matter in the future to match the cure times by adjusting the amounts of accelerators/curing agents. Data provided by others suggest that no change in performance will occur when the curing time is the same as the virgin rubber.

Stiffness
In our perfectly controlled tests, the moduli at 100% elongation (as well as higher elongation moduli) were higher than the modulus of the 100% virgin rubber.

Hardness and Cut Strength
The hardness is simply the arithmetic average of Purus™ Rubber, powered by Levgum technology, and virgin rubber. The cut strength behavior is expected to be somewhere between the arithmetic average and the behavior of the tensile strength.

What technological issues will have to be addressed in an industrial scale facility?

Quality control of the incoming raw material
There are two issues: particle size and chemical composition of the rubber crumb. The more uniform the particle size and chemical composition the higher quality of the Purus™ Rubber, powered by Levgum technology.

Proper Mixing Procedures
Purus™ Rubber, powered by Levgum technology, and the tested virgin rubber were mixed very well under my supervision at ARDL. There are two issues with respect to mixing. The first is that many passes through a roll-mill to mix the devulcanization agent and rubber crumb are required. The minimum number of passes will depend on crumb particle size. The second issue is that the Purus™ Rubber, powered by Levgum technology, and the virgin rubber should be well mixed to achieve the best performance. The necessary procedures to produce a well-mixed rubber will consist of mixing in an internal mixer followed by multiple passes through a roll-mill with chilled rollers. It is possible internal mixing alone will produce a good enough mixture, but I think it unlikely. All pieces of equipment are standard to the industry.

Maximum Substitution Level
For the maximum cost-savings, the higher the Purus™ Rubber, powered by Levgum technology, substitution level, the better. However, it is probably not the cured rubber performance that will determine the highest substitution level possible, it is the ability to handle and mix the uncured Purus™ Rubber,

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powered by Levgum technology, plus virgin rubber. Above about 50% substitution, continuous large sheets may be difficult to form without modifiers. At 20% substitution, the material handles nearly identical to 100% virgin rubber.

In summary, I could not be more pleased with the outstanding test results from ARDL on Purus™ Rubber, powered by Levgum technology, and believe that this technology can significantly increase and improve recycling of already-used rubber as well as reduce the amount of precious fossil fuels used to make new rubber.

Website: www.levgum.com

Please feel free to contact me if you have any questions.

Dr. Brian Grady

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President's Associate Presidential Professor
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The Power of Rubber Recycling

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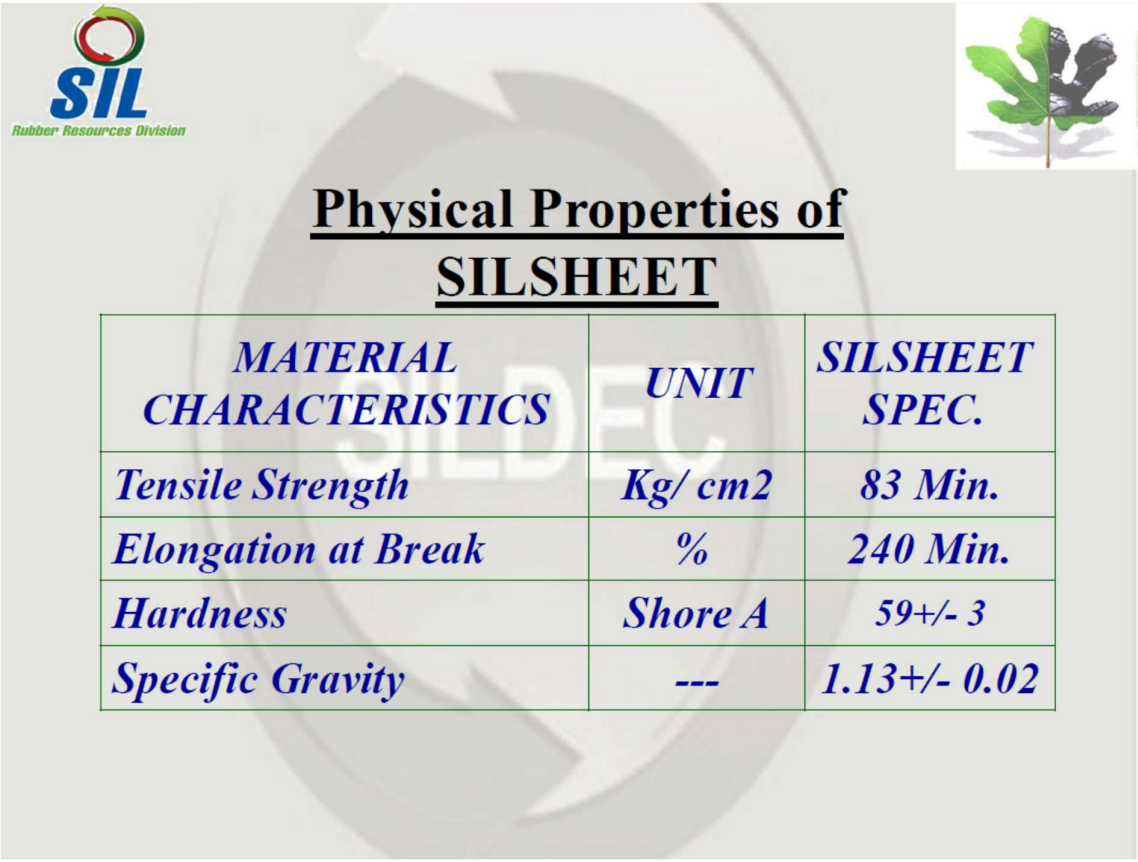
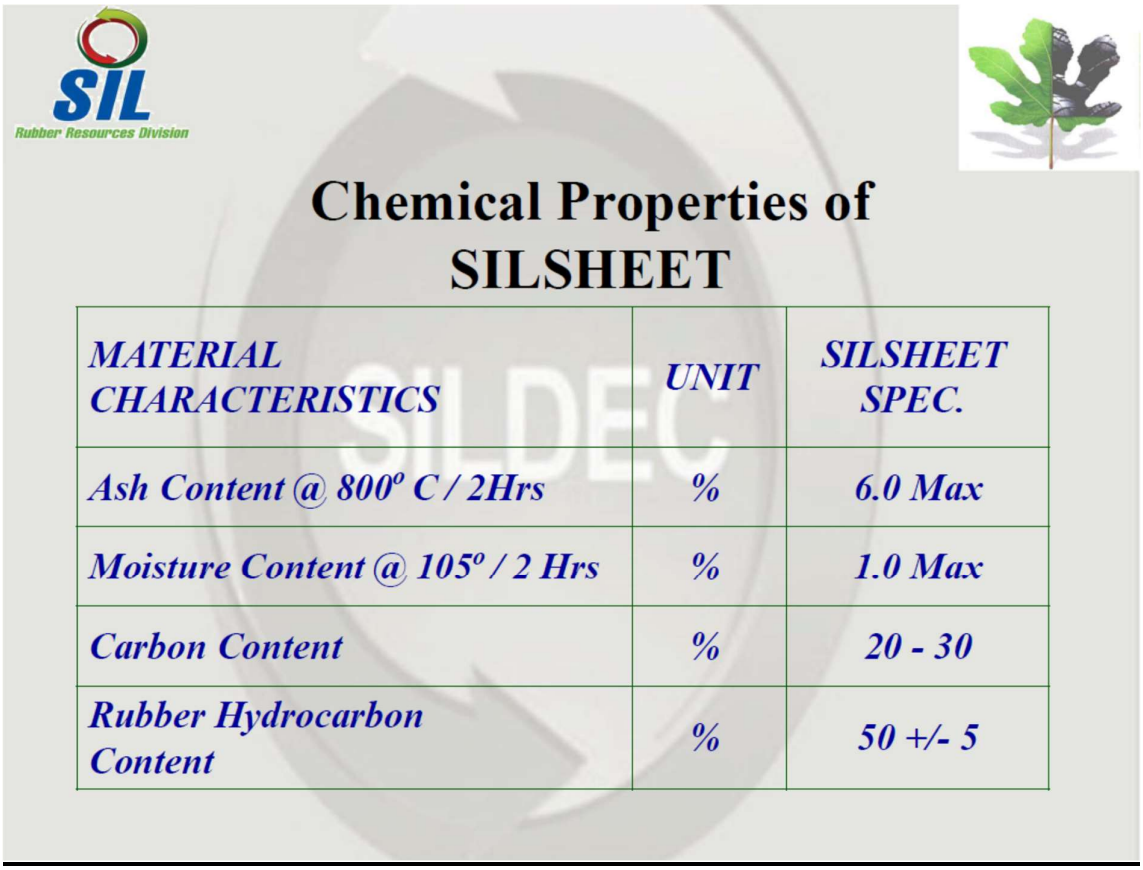
SILSHEET

Physical properties



Sundaram Industries Privet Limited (http://www.silrubberresources.com/) was established in 1943 as part of the TVS Group. One of the most respected business groups in India. the Group is the largest 2-wheeler tyre manufacturer in India. SIPL is specialized in solid tyres sold all over the world.
It has been Levgum's licensee since 2003

Chemical properties



SILSHEET vs. Reclaim Rubber

SIL
Rubber Resources Division

SILSHEET Vs High Tensile Reclaim and Superfine Reclaim

Test Results	Units	Silsheet	SF Reclaim	HT Reclaim
Tensile Strength	Kg/cm^2	83	33	68
		85	35	65
		85	35	68
Elongation Break	%	260	120	240
		240	120	240
		260	120	240

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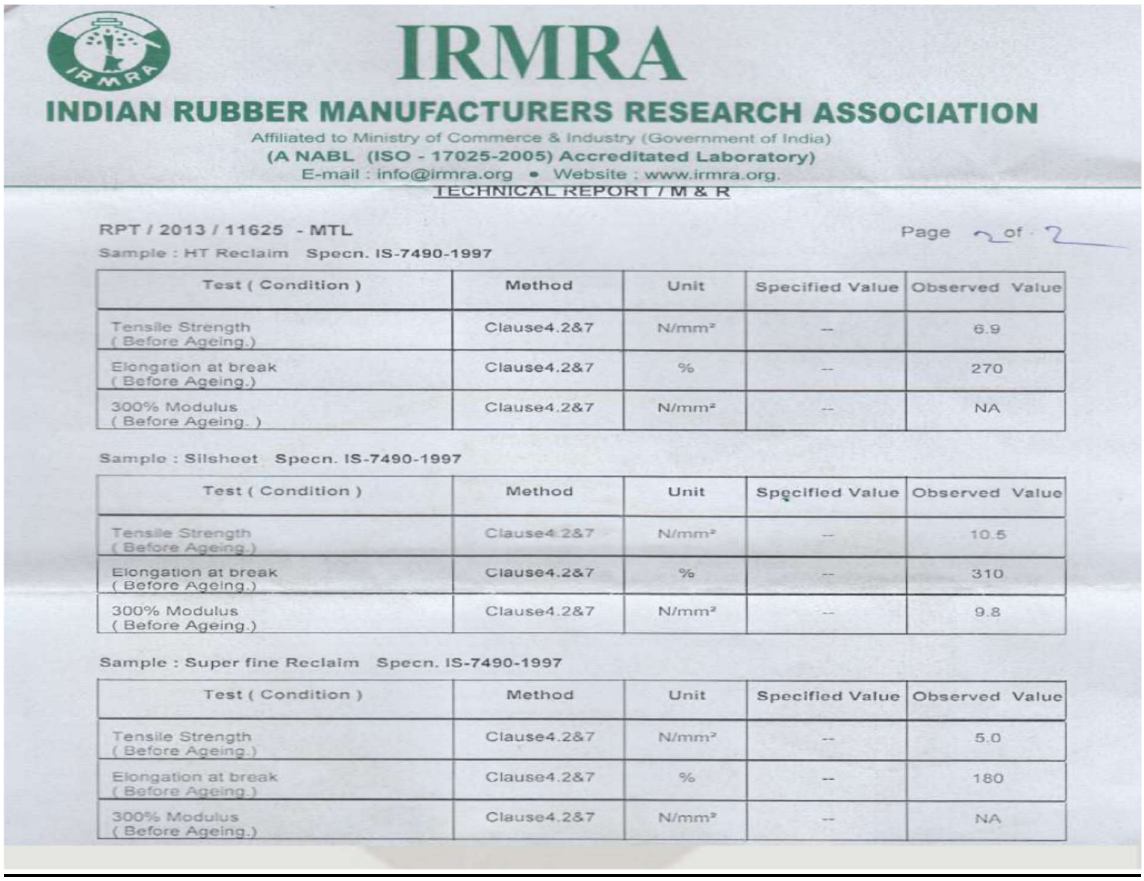

IRMRA

INDIAN RUBBER MANUFACTURERS RESEARCH ASSOCIATION

Affiliated to Ministry of Commerce & Industry (Government of India)
(A NABL (ISO - 17025-2005) Accreditated Laboratory)
E-mail : info@irmra.org • Website : www.irmra.org.

TECHNICAL REPORT / M & R

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Sample : HT Reclaim Specn. IS-7490-1997

Test (Condition)	Method	Unit	Specified Value	Observed Value
Tensile Strength (Before Ageing.)	Clause4.2&7	N/mm²	--	6.9
Elongation at break (Before Ageing.)	Clause4.2&7	%	--	270
300% Modulus (Before Ageing.)	Clause4.2&7	N/mm²	--	NA

Sample : Silsheet Specn. IS-7490-1997

Test (Condition)	Method	Unit	Specified Value	Observed Value
Tensile Strength (Before Ageing.)	Clause4.2&7	N/mm²	--	10.5
Elongation at break (Before Ageing.)	Clause4.2&7	%	--	310
300% Modulus (Before Ageing.)	Clause4.2&7	N/mm²	--	9.8

Sample : Super fine Reclaim Specn. IS-7490-1997

Test (Condition)	Method	Unit	Specified Value	Observed Value
Tensile Strength (Before Ageing.)	Clause4.2&7	N/mm²	--	5.0
Elongation at break (Before Ageing.)	Clause4.2&7	%	--	180
300% Modulus (Before Ageing.)	Clause4.2&7	N/mm²	--	NA

IRMRA – Indian Rubber Manufacturers Research Association (https://irmra.org/) holds one of India's most lucrative rubber laboratories highly considered for professionalism and honesty.

Field tests

SIL
Rubber Resources Division

Field Test Performance of 63phr SILSHEET in TRUCK Application

Field Test Details	Trial 4	Trial 4	Trial 4	Trial 4	Trial 5	Trial 5
Vehicle Type	Bus				Bus	
Route	Highway and Rough Road(Gudiyatam- Kandapalli)				Highway and Rough Road(Vaniyambadi-Ambur	
No of Kms Run	40126	40126	40126	40126	20900	20900
Remaining Skid Depth	4 mm	4 mm	4 mm	4 mm	5 mm	5 mm
Normal mileage in this Route	Equal with Regular	Equal with Regular	Equal with Regular		Equal with Regular	
Compound Details	63 phr (28%Silsheet)			Regular Ultra compd.	63 phr (28%Sil sheet)	Regular Ultra compd.
Tyre No	MF3025900 2211	MF3032987 2211	MF3020215 2211	MF3020114 2211	BR2008383 2212	BR2018327 3812

Field tests with high SILSHEET load (70% by weight)

SIL
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Field Test Performance of SILSHEET in CAR/VAN Application

Field Test Details	Trial 1	Trial 2	Trial 3	Trial 4
Vehicle Type	Ambassador Car	Ambassador Car	Ambassador Car	TATA Safari
Route	Highway and Rough Road	City Base and 20% outer running	City Base and 40% outer running	City base and 20% outer Running
No of Kms Run	**37010**	**33150**	**28120**	**24100**
Remaining Skid Depth	1 mm	1.5 mm	1.5 mm	4 mm
Normal mileage in this Route	30,000 - 35000	30,000 - 35000	25,000 - 30000	45,000
Compound Details	70% Silsheet	70% Silsheet	70% Silsheet	70% Silsheet
Tyre No	MF50968531410	JKB0006943210	MRF 44084211911	CDC 2808

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Website: www.levgum.com

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Field Test Performance of SILSHEET in VAN / OTR Application

Field Test Details	Trial 5	Trial 6	Trial 6
Vehicle Type	Van	Tractor	Tractor
Route	Highway and Rough Road	Agriculture field	Agriculture field
No of Kms Run	**15700**	**1020 hrs**	**1020 hrs**
Remaining Skid Depth	6mm	12 mm	11.5 mm
Normal mileage in this Route	Around 25000	Around 1500 hrs	Around 1500 hrs
Compound Details	70% Silsheet	70% Silsheet in OTR	70% Silsheet in OTR
Tyre No	MF10503403809	A13568870	A13527570

Nitril Rubber
(Client allowed use of data without his name for his own reasons)

Blends of DRC with virgin rubber compounds

Tables 1 and 2 represent application of DRC in nitrile compounds. DRC obtained from corresponding nitrile scrap was used in both cases.

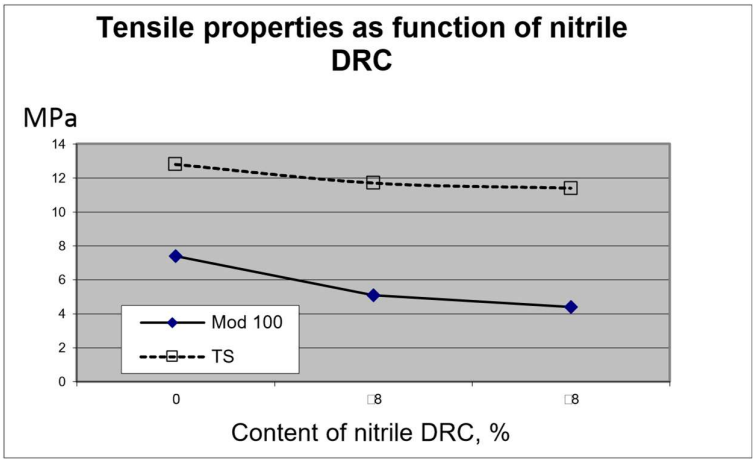
Content of NBR pipes compound	***Content of DRC***	Mod 100	Mod 300	TS	EB	Hardness	Sp. gravity
100	***0***	1.5	2.1	3.5	563	60	1.62
80	***20***	1.4	2.2	3.1	570	58	1.64

Table 1: NBR pipes compound

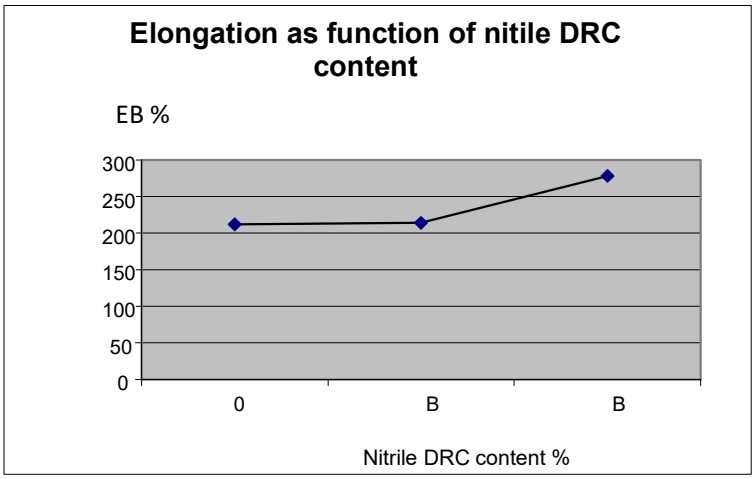
Table 2 shows full applicability of 20% DRC-containing compound as substitute of virgin one. Main property for pipes – Elongation – has been even improved at addition of DRC.

Content of nitrile rubber	***Content of DRC***	Mod 100	TS	EB	Hardness
100	***0***	7.4	12.8	212	83
85	***15***	5.1	11.7	214	80
15	***85***	4.4	11.4	278	78

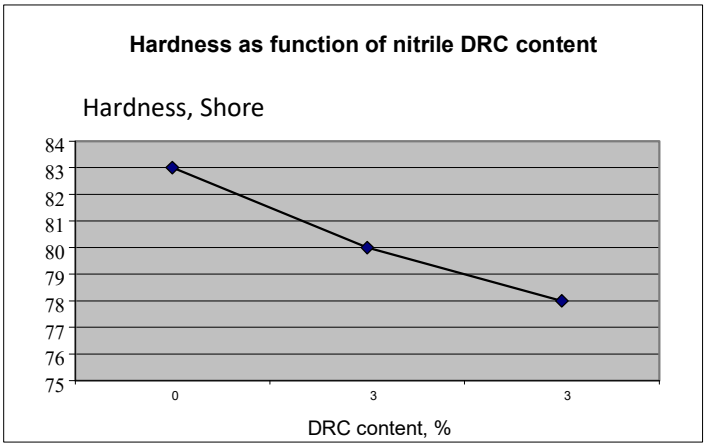
Table 2: full applicability of 20% DRC-containing compound as substitute of virgin one. Main property for pipes – Elongation – has been even improved at addition of DRC.



Picture 1: Tensile properties



Picture 2: Elongation at Break



Picture 3: Hardness, Shore

Phenomenal effect has demonstrated nitrile hose compound as it is shown in Table 3 and pictures 1, 2 and 3: test revealed improvement or good retention of main parameters of this compound even at content of DRC 85%.

Conclusions

1. DRC proved its applicability in Nitrile compounds with virgin rubber blends for pipes & hoses industry etc.
2. Addition of DRC or substitution of the part of entire blend for DRC is the most effective way of its application in compounds. Under no circumstances should substitution of virgin rubber only for DRC be recommended.