



Polymers

SPECIALTY CARBONS FOR RUBBER COMPOUNDS

ENSACO[®]

TIMCAL Carbon Black

TIMREX[®]

TIMCAL Graphite

imerys-graphite-and-carbon.com

Imerys Graphite & Carbon

WHO ARE WE?

Imerys Graphite & Carbon has a strong tradition and history in carbon manufacturing. Its first manufacturing operation was founded in 1908. Today, Imerys Graphite & Carbon facilities produce and market a large variety of synthetic and natural graphite powders, conductive carbon blacks and water-based dispersions of consistent high quality. Adhering to a philosophy of Total Quality Management and continuous process improvement, all Imerys Graphite & Carbon manufacturing plants comply with ISO 9001:2008. Imerys Graphite & Carbon is committed to produce highly specialized graphite and carbon materials for today's and tomorrow's customers needs. Imerys Graphite & Carbon belongs to Imerys, the world leader in mineral-based specialties for industry.

WHERE ARE WE LOCATED?

With headquarters located in Switzerland, Imerys Graphite & Carbon has an international presence with production facilities and commercial offices located in key markets around the globe. The Group's industrial and commercial activities are managed by an experienced multinational team of more than 430 employees from many countries on three continents.

For the updated list of commercial offices and distributors please visit www.imerys-graphite-and-carbon.com



Lac-des-Îles, Canada
Mining, purification and sieving of natural graphite flakes



HQ Bodio, Switzerland
Graphitization and processing of synthetic graphite, manufacturing of water-based dispersions, processing of natural graphite and coke, and manufacturing and processing of silicon carbide



Changzhou, China
Manufacturing of descaling agents and processing of natural graphite



Terrebonne, Canada
Exfoliation of natural graphite, processing of natural and synthetic graphite



Willebroek, Belgium
Manufacturing and processing of conductive carbon black



Fuji, Japan
Manufacturing of water-based dispersions

WHAT IS OUR MISSION?

To promote our economic, social and cultural advancement with enthusiasm, efficiency and dynamism by offering value, reliability and quality to ensure the lasting success of our customers.

WHAT IS OUR VISION?

To be the worldwide leader and to be recognized as the reference for innovative capability in the field of carbon powder-based solutions.

ENSACO® TIMCAL carbon black

ENSACO® 250G CONDUCTIVE CARBON BLACK

Properties

- High structure / low surface area
- Soft flakes
- Low oxygen content
- High purity
- High graphiticity

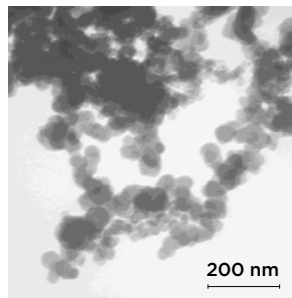
Performance

- Electrical conductivity
- Excellent dispersion
- Low viscosity increase
- Low cure inhibition
- Easy mixing and processing
- Some thermal conductivity
- Meets the most stringent purity requirements

Final applications

Automotive fuel hoses, transmission belts, conveyor belts, power cable accessories, thin membranes with high shock resistance, conductive profiles and seals, antistatic flooring, rollers, roller covering...

Suitable for all rubber types including silicones and fluoroelastomers.



ENSACO® 350G EXTRA-CONDUCTIVE CARBON BLACK

Properties

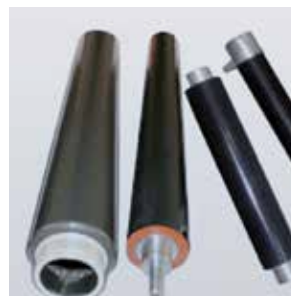
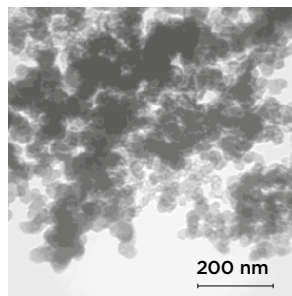
- Very high structure very high surface area
- High purity

Performance

- Electrical conductivity booster
- UHF curing booster

Final applications

Power cable accessories, rollers, roller covering, microwave heating of thick rubber parts, shoe soles, heat shrinkable tubes...



TIMREX® TIMCAL graphite

TIMREX®

Properties

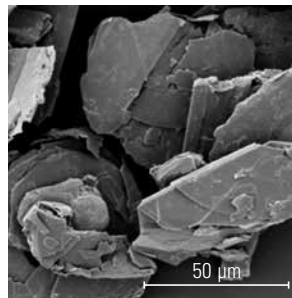
- High crystallinity
- High carbon content
- Lamellar structure
- Various shapes and sizes

Performance

- Self-lubrication
- Thermal and electrical conductivity
- Gas barrier

Final applications

Seals and gaskets, friction parts, heat exchangers, parts with high operating temperatures, gas barrier membranes...



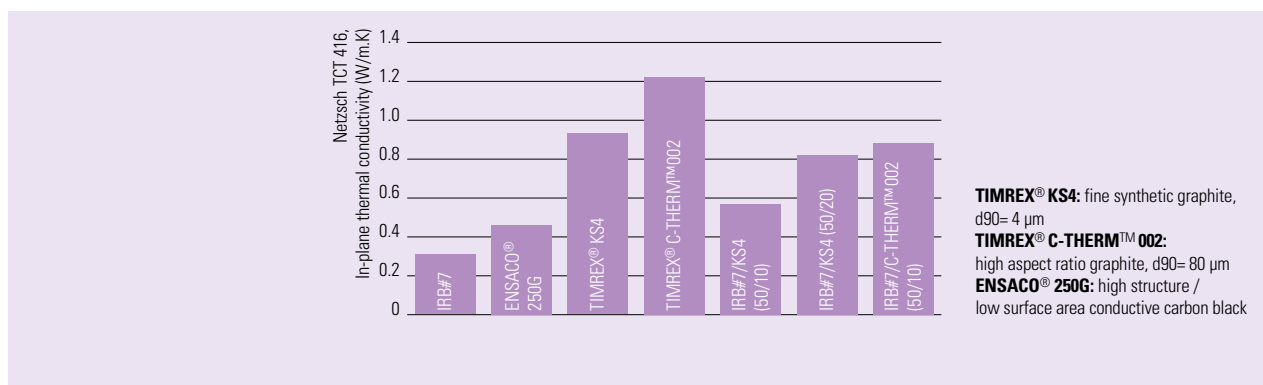
THERMAL CONDUCTIVITY / HEAT MANAGEMENT

- Thermal conductivity for in-use application
 - efficient heat transfer, increase temperature stability
- Thermal conductivity helping during the processing
 - to lower t90 of thick rubber pieces

There is a trend to thermally conductive solutions which is a field to explore with graphite, especially with TIMREX® C-THERM™ carbon-based product family

Results in SBR (ASTM D3191)

50 phr filler (carbon black or graphite) or phr as indicated for filler blends



IRC 2005, T. Gruenberger, N. Probst, TIMCAL paper

✓ Thermal conductivity efficiency

ENSACO® gives electrical conductivity to rubber at low loadings, with additional key benefits

	PRODUCTION PROCESS	PROPERTIES	OAN STRUCTURE (ml/100g)	BET SURFACE AREA (m ² /g)	ASH CONTENT (%)	GRIT 325 MESH 45 µm (ppm)	SULPHUR CONTENT (ppm)	CONDUCTIVITY	DISPERSION	PURITY
SCF N472	Furnace	HS/HSA	178	250	0.03	< 20	4700	++	+	+
ENSACO® 250G		HS/LSA	190	65	0.01	< 2	100	+++	+++	+++
ENSACO® 350G		VHS/VHSA	320	770	0.02	< 10	150	++++	-	++(+)

HS = high structure, VHS = very high structure, LSA = low surface area, HSA = high surface area, VHSA = very high surface area

RESULTS IN NBR

ENSACO® 250G (HS/LSA) vs N472 (HS/HSA):

- lower Mooney
- higher EatB
- lower Moduli/TS
- higher tear strength
- lower hardness
- same curing properties
- lower resistivity

NBR COMPOUNDS	A	B	C	D
NBR NT 3945	100	100	100	100
ENSACO® 250G	20	25	30	
SCF N472				25
N550	40	40	40	40
ZnO	4	4	4	4
Stearic acid	0.5	0.5	0.5	0.5
DOP	30	30	30	30
Sulphur	0.4	0.4	0.4	0.4
Methyl thuads	2	2	2	2
Amax	2	2	2	2

ML(1 + 4) at 100°C (MU)	38.1	45.7	50.6	47.2
Rheometer at 155°C				
min. torque (dNm)	1.00	1.39	1.61	1.33
max. torque (dNm)	20.57	22.62	24.06	22.86
Delta torque (dNm)	19.57	21.23	22.45	22.53
t90 (min)	11.82	11.46	11.83	11.37

Hardness shore A	67.9 +/- 0.2	70.9 +/- 0.3	72.8 +/- 0.2	72.2 +/- 0.5
Stress strain (S2, 500 mm/min)				
Tensile strength (MPa)	13.2 +/- 0.3	13.8 +/- 0.6	13.7 +/- 0.7	14.8 +/- 0.3
Elongation at break (%)	354 +/- 10	339 +/- 24	335 +/- 23	311 +/- 10
Modulus 100% (MPa)	3.5 +/- 0.0	3.9 +/- 0.1	4.2 +/- 0.1	4.6 +/- 0.1
Modulus 200% (MPa)	7.7 +/- 0.0	8.6 +/- 0.1	9.0 +/- 0.1	10.3 +/- 0.2
Modulus 300% (MPa)	11.6 +/- 0.1	12.6 +/- 0.2	12.8 +/- 0.1	14.4 +/- 0.2
Tear strength (N/mm ²)	30.2	32.4	29.7	31.8
Resistivity (Ohm.cm)	130	79	44	360

✓ Easy compounding and processing

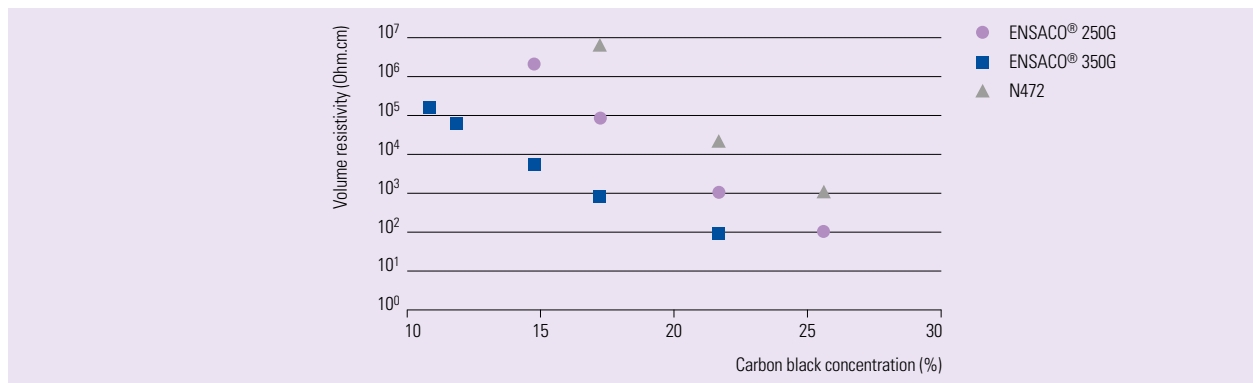
✓ Excellent extrusion properties

ENSACO® gives electrical conductivity to rubber at low loadings, with additional key benefits

RESULTS IN EPDM

ENSACO® 250G (HS/LSA) vs N472 (HS/HSA):

- better dispersion
- lower energy needed for the mixing
- lower structure compression
- lower resistivity



EPDM OE-130; CB-VAR.; ZNO-5; PEROXIDE-5

✓ High conductivity efficiency

RESULTS IN FKM

- ENSACO® 250G (HS/LSA) enables to make FKM conductive with acceptable viscosity, ease of processing and adequate mechanical performance
- N990 (MT black) and N472 (HS/HSA) fail
- Blends of N990 and ENSACO® 250G help to adjust the required end properties

	A HS/LSA	B HS/HSA	
VITON A-32J	100	100	
MgO	3	3	
Ca(OH) ₂	3	3	
MT black	0	0	
ENSACO® 250G	20	0	
N472	0	20	
VPA-2	1	1	
Uncured properties			
Mooney viscosity ML(1+10 ¹), 100°C	87.7	107.3	⚠
Rheometry ODR 177°C (max 12 min)			
ts2 (min)	2.6	6.6	
tc90 (min)	4.4	20.4	⚠
Cured properties (177°C, 10 min)			
Volume resistivity (Ohm.cm)	27	26	
Compression set (%)	44.9	65	
Module 100% (kg/cm ²)	60	39	
Module 300% (kg/cm ²)	127	52	
Tensile strength (kg/cm ²)	140	54	
Elongation at break (%)	370	560	⚠
Hardness (shore A)	83	82	

Courtesy of DuPont Performance Elastomers, Japan.

Incomplete vulcanisation

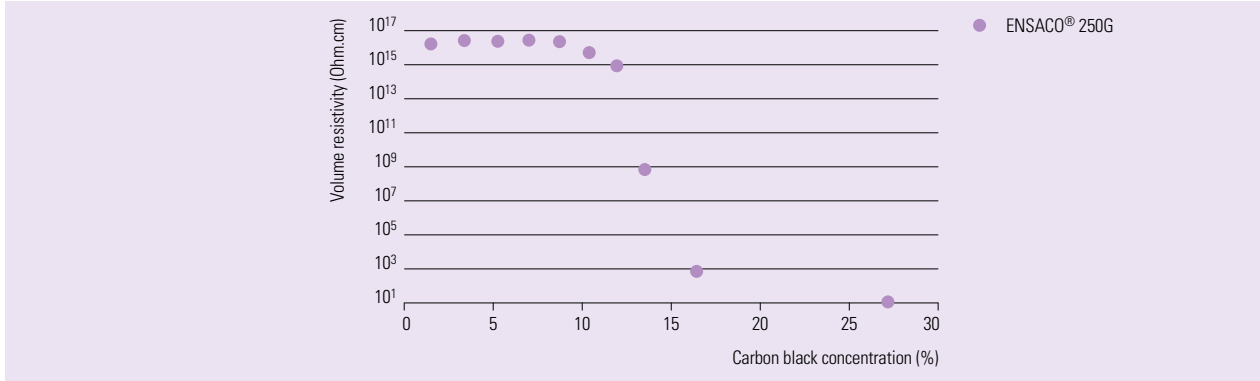
✓ Low viscosity

✓ Excellent compounding and extrusion of conductive FKM

RESULTS IN SILICONE

ENSACO® 250G (HS/LSA):

- low peroxide cure inhibition thanks to low surface oxygen content
- suitable for Pt cured silicone thanks to very low sulphur and metal impurities



ENSACO® 250G			
	16phr 14%	20phr 17%	37.5phr 27%
Rheometry MDR 180°C, 6 min			
MH (lb.in)	16.3	17.0	21.1
ML (lb.in)	1.0	1.2	3.3
delta (lb.in)	15.3	15.8	17.8
ts2 (min)	00:32	00:34	00:38
t50 (min)	01:05	01:15	01:38
t90 (min)	02:44	03:10	03:51
Volume resistivity (Ohm.cm)	108	830	13

Mixes: courtesy of Helvoet, NL

✓ High purity

✓ Ideal for trace sensitive polymers like silicones



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