



BIRLA CARBON

CARBON BLACKS FOR RUBBER
APPLICATIONS

ADITYA BIRLA



BIRLA CARBON

Carbon black is the predominant reinforcing filler used in rubber compounds, and the improvement in rubber properties is a function of the fundamental physical and chemical characteristics of the carbon black, which include aggregate size and structure, particle size (surface area), surface activity, and porosity. Carbon blacks are manufactured with a very wide range of surface area and structure combinations to provide the rubber compounder the utmost flexibility in tailoring their specific rubber compound requirements. Grades defined by ASTM International, designated as the N series, have well defined structure and surface area targets for customers' convenience. In addition to these materials, Birla Carbon has developed a range of unique products, designated Birla Carbon™ products, which provide differentiated performance for a wide range of tire and rubber goods applications.



Carbon Black Characteristics

PARTICLE SIZE. This fundamental property of carbon black has a significant effect on rubber properties. Typical carbon black particle sizes for furnace blacks range from approximately 8 nanometers to 100 nanometers. Smaller particle size increases the specific surface area (m²/g) of the carbon black. Smaller particle size and higher specific surface area lead to increased reinforcement, increased abrasion resistance, improved tensile strength and higher hysteresis. However, to disperse smaller particle size carbon blacks requires increased mixing time and energy. Particle size and its distribution can only be measured using a transmission electron microscope.

AGGREGATE SIZE. Carbon black particles coalesce during formation to form carbon black aggregates, which are the true primary unit of carbon black. The number of primary particles and degree of branching in the carbon black aggregate determines its structure level, which has a direct impact on several important in-rubber properties. For example, increasing carbon black structure increases modulus, hardness, electrical conductivity, and improves dispersibility of the carbon black, but also increases compound viscosity.

SURFACE ACTIVITY. The organophilic nature of the carbon black surface lends itself to a very synergistic and high level of carbon-black-elastomer interaction that greatly improves the abrasion resistance, tensile strength, hysteresis, and modulus of a rubber compound, without coupling agents or intensive mixing. The surface characteristics of carbon black are difficult to precisely define, but the surface structure of carbon black is believed to be composed of graphene layers oriented in a tile-like fashion with exposed edge sites that contain various functional groups composed of hydrogen and oxygen.

POROSITY. This fundamental property of carbon black can affect the measurement of surface area resulting in a total surface area (nitrogen specific surface area or NSA) larger than the external or non-porous surface area (statistical thickness surface area or STSA). Increasing the porosity reduces the envelope density of the aggregates. This results in a higher volume fraction of carbon black at a given loading that leads to an increase in compound modulus and electrical conductivity.

PHYSICAL FORM. This property of carbon black is also important and the most common physical form of carbon blacks for rubber applications is beads (pellets). Pelletization densifies the carbon black for improved handling, mixing and dispersion.

Birla Carbon™ Product Range for Differentiated Performance

FOR MECHANICAL RUBBER GOODS

Birla carbon has a comprehensive range of ASTM and differentiated Birla Carbon™ products for use in rubber goods applications. The Birla Carbon product line features products with tailored morphologies and physical form for enhanced conveying, dispersion and processing, and products with controlled ash and residue levels for superior extruded surface finish and durability. These products are targeted for a diverse range of applications such as:

- *Rubber belts, tracks and anti-vibration devices, where dynamic performance and durability of components are key factors,*
- *Extruded sealing applications such as Class A automotive profiles where surface appearance, compound resistivity targets and throughput are critical,*
- *Various fluid transfer applications as well as injection molded seals and gaskets.*

The Birla Carbon product line also includes a wide selection of products with low PAH (Polycyclic Aromatic Hydrocarbon) content to meet regulatory targets for rubber compounds in a wide range of applications.

FOR TIRE APPLICATIONS

To enable the tire manufacturer to meet the requirements for lower rolling resistance while maintaining or improving treadwear and traction, Birla Carbon has developed a range of carbon blacks that overcome the traditional trade-offs in these properties.

Additionally the Birla Carbon product line includes differentiated products that range from use in Commercial Tires for improved durability for on and off-road applications, to UHP (Ultra-High Performance) and Racing Tires for an improved grip.

New Rubber Carbon Blacks



Birla Carbon is constantly exploring ways to improve carbon black performance in rubber applications. Contact your Birla Carbon sales or technical service representative for the latest information on new rubber grades developed by Birla Carbon.

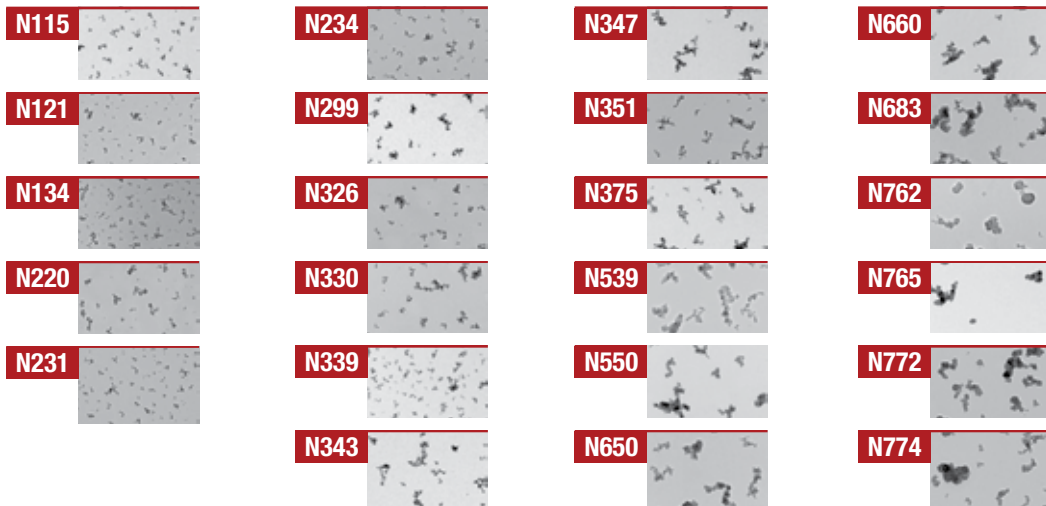
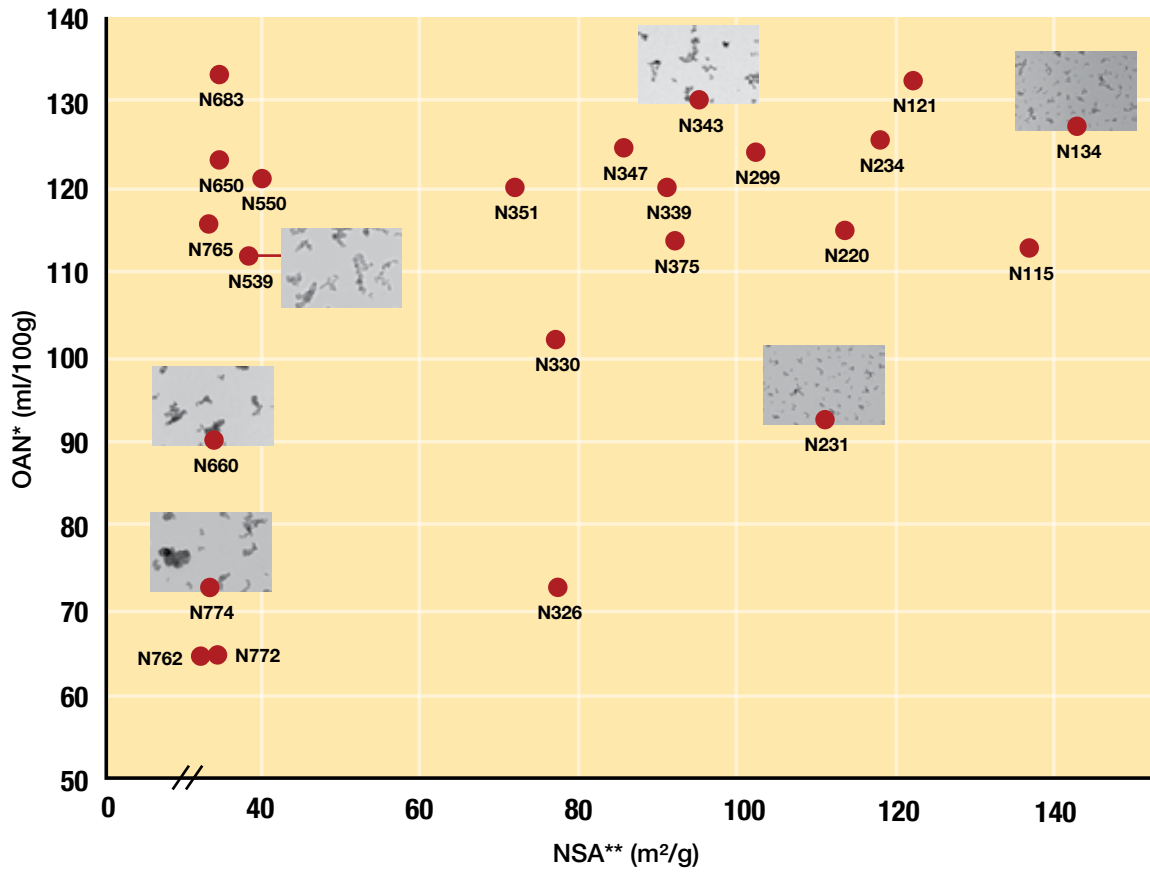
Recommended Product

Applications in Rubber		N115	N121	N134	N220	N231	N234	N299	N326	N330	N339	N343	N347	N351	N375	N539	N550	N650	N660	N683	N762	N765	N772	N774	
Tires	Performance/ Racing Tread	■	■	■			■																		
	Passenger Car Tread			■	■		■	■		■	■	■	■		■										
	Commercial Vehicle Tread	■	■	■	■	■	■	■		■	■	■	■		■										
	Inner Liner																		■		■		■	■	
	General Carcass								■	■	■	■	■	■	■	■	■	■			■		■		
	Off the Road	■	■	■	■	■	■	■		■	■	■	■		■										
	All Terrain			■	■		■	■		■	■	■	■		■										
	Two Wheeler		■	■	■		■	■		■	■	■	■		■										
	Side Wall									■	■	■	■	■	■	■	■	■	■	■					

Applications in Rubber		N115	N121	N134	N220	N231	N234	N330	N339	N343	N351	N375	N539	N550	N650	N660	N683	N762	N765	N772	N774			
Mechanical Rubber Goods	Class A Profiles																							
	Class B / Building Profiles												■	■	■	■	■	■	■	■	■	■	■	■
	Coolant Hoses												■	■	■	■	■	■	■	■	■	■	■	■
	Fuel Hoses												■	■	■	■	■	■	■	■	■	■	■	■
	Non-Automotive Hoses												■	■	■	■	■	■	■	■	■	■	■	■
	Industrial Conveyor Belts				■		■	■	■			■		■										
	Timing Belts												■	■	■	■	■	■	■	■	■	■	■	■
	Drive Belts												■	■	■	■	■	■	■	■	■	■	■	■
	Anti-Vibration - High Frequency												■	■	■	■	■	■	■	■	■	■	■	■
	Anti-Vibration - High Amplitude							■	■	■	■	■												
	Anti-Vibration - Non Automotive												■	■	■	■	■	■	■	■	■	■	■	■
	Footwear															■								
	Roofing							■						■	■									
	O-Rings / Gaskets												■	■	■	■	■	■	■	■	■	■	■	■
	Masterbatch / Compounding				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Solid Tire				■		■	■	■			■		■	■									
	Tracks	■	■	■	■		■	■	■			■		■	■									

For a more precise product recommendation, please consult your Birla Carbon sales or technical service representative, the Birla Carbon Solutions Guide at <https://birlacarboncommunity.force.com/s/> or **download our app**.

Dimensional Classification of Rubber Grade Carbons



* OAN: Oil Absorption Number

** NSA: Nitrogen Specific Surface Area

Typical Colloidal Properties (ASTM D1765)

ASTM Designation	NSA (m ² /g)	STSA (m ² /g)	Tint (%)	Iodine (mg/g)	OAN (ml/100g)	COAN (24M4) (ml/100g)	Pour Density (kg/m ³)
N115	137	124	123	160	113	97	345
N121	122	114	119	121	132	111	320
N134	143	137	131	142	127	103	320
N220	114	106	116	121	114	98	355
N231	111	107	120	121	92	86	400
N234	119	112	123	120	125	102	320
N299	104	97	113	108	124	104	335
N326	78	76	111	82	72	68	455
N330	78	75	104	82	102	88	380
N339	91	88	111	90	120	99	345
N343	96	92	112	92	130	104	320
N347	85	83	105	90	124	99	335
N351	71	70	100	68	120	95	345
N375	93	91	114	90	114	96	345
N539	39	38	-	43	111	81	385
N550	40	39	-	43	121	85	360
N650	36	35	-	36	122	84	370
N660	35	34	-	36	90	74	440
N683	36	34	-	35	133	85	355
N762	29	28	-	27	65	59	515
N765	34	32	-	31	115	81	370
N772	32	30	-	30	65	59	520
N774	30	29	-	29	72	63	490

Test Procedures

Tinting Strength: ASTM D3265 STSA; ASTM D6556 OAN; ASTM D2414

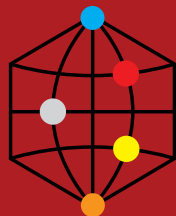
Pour Density: ASTM D1513

Iodine Number: ASTM D1510 NSA; ASTM D6556 COAN; ASTM D3493

Carbon black has the CAS number 1333-86-4

About Birla Carbon

Birla Carbon is one of the world's largest manufacturers and suppliers of high quality carbon black and a flagship business of the Aditya Birla Group. Our contemporary research infrastructure and state-of-the-art technology centers provide carbon black solutions to leading companies in the rubber and specialty applications sectors worldwide.



**SHARE THE
STRENGTH**

As an ardent practitioner of sustainable development, Birla Carbon's Sustainable Operational Excellence (SOE) strategy focuses on employee safety, environmental stewardship, efficient use of carbon sources and a key focus on conducting operations in a socially and ethically responsible manner. In 2019, Birla Carbon was awarded a Gold level rating for sustainable practices for the fourth consecutive year by EcoVadis.

Birla Carbon's Purpose, **Share the Strength**, is about balanced and shared leadership, working at the product level to innovate cutting edge solutions, through collaboration with its people, customers and communities and backed by knowledge built over a century.

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