Ram Charan
PRODUCT DEVELOPMENT INFORMATION

VOLUME 1
ISSUE 5
SEPTEMBER 2011

CARBON BLACK - ITS INFLUENCE & SELECTION CRITERIA

THE SELECTION OF THE GRADE OF CARBON BLACK IS PRIMARILY BASED ON THE SURFACE AREA AND STRUCTURE, AND IN NICHE APPLICATIONS ON THE SURFACE MODIFICATIONS.

THE INFLUENCE of the Surface Area and the Structure on the Properties and Performance of the Rubber is as follows:

WHEN SURFACE AREA OF THE CARBON BLACK INCREASES

PARTICLE SIZE	DECREASES
AGGREGATE SIZE	DECREASES
IODINE NUMBER	INCREASES
ELONGATION	NO CHANGE SIGNIFICANTLY
HARDNESS	INCREASES
IMPACT RESISTANCE	DECREASES
ABRASION RESISTANCE	INCREASES
LOADING CAPACITY IN THE COMPOUND	DECREASES
MIX INCORPORATION TIME IN THE COMPOUND	INCREASES
MOONEY VISCOSITY OF THE RUBBER COMPOUND	INCREASES
EXTRUSION SHRINKAGE(DIE SWELL)	NOT VARIES SIGNIFICANTLY
DIMENSIONAL STABILITY(GREEN)	NOT VARIES SIGNIFICANTLY
TENSILE STRENGTH	INCREASES
MODULUS	NOT SIGNIFICANTLY IMPROVED.

WHEN STRUCTURE OF THE CARBON BLACK INCREASES

PARTICLE SIZE	NO EFFECT
AGGREGATE SIZE	INCREASES
IODINE NUMBER	NO EFFECT
ELONGATION	DECREASES
HARDNESS	INCREASES
IMPACT RESISTANCE	NO SIGNIFICANT EFFECT
ABRASION RESISTANCE	INCREASES
LOADING CAPACITY IN THE COMPOUND	DECREASES
MIX INCORPORATION TIME IN THE COMPOUND	INCREASES
MOONEY VISCOSITY OF THE RUBBER COMPOUND	INCREASES
EXTRUSION SHRINKAGE(DIE SWELL)	DECREASES
DIMENSIONAL STABILITY(GREEN)	INCREASES
TENSILE STRENGTH	NO SIGNIFICANT EFFECT
MODULUS	INCREASES

SELECTION GUIDE OF ASTM GRADES OF HITECH CARBON GRADES

QUALITY PARAMETERS OF BIRLA CARBON GRADES

ASTM GRADE	Tint Strength	DBP Absorption	Iodine Adsorption	N2 SA Miltipoint Adsorption	STSA Adsorption	24M4 DBP Adsorption	Heat Loss	Pour Density	300% Mod. (w.r.t IRB 7)
	(%ITRB)	(cc/100g)	(g/kg)	(m^2/g)	(m^2/g)	(cc/100 g)	(% max)	(Kg/m^3)	(Mpa)
	D 3265	D 2414	D 1510	D 4820	D 5816	D 3493	D 1509	D 1513	D 3192/ D 412
N110	123	113	145	127	115	97	2.0	345	(-) 3.2
N115	123	113	160	137	124	97	2.0	345	(-) 3.1
N121	119	132	121	122	114	111	2.0	320	(-) 0.1
N134	131	127	142	143	137	103	2.0	320	(-) 1.5
N219	123	78	118	120	-	75	1.5	440	(-) 6.0
N220	116	114	121	114	106	98	1.5	355	(-) 2.0
N231	120	92	121	111	107	86	1.5	400	(-) 4.6
N234	123	125	120	119	112	102	1.5	320	(-) 0.1
N299	113	124	108	104	97	104	1.5	335	(+) 0.7
N326	111	72	82	78	76	68	1.5	455	(-) 3.6
N330	104	102	82	78	75	88	1.5	380	(-) 0.6
N339	111	120	90	91	88	99	1.5	345	(+) 0.9
N347	105	124	90	85	83	99	1.5	335	(+) 0.5
N351	100	120	68	71	70	95	1.5	345	(+) 1.1
N358	98	150	84	80	78	108	1.5	305	(+) 2.3
N375	114	114	90	93	91	96	1.5	345	(+) 0.4
N539	-	111	43	39	38	81	1.5	385	(-) 1.3
N550	-	121	43	40	39	85	1.5	360	(-) 0.6
N650	-	122	36	36	35	84	1.5	370	(-) 0.7
N660	-	90	36	35	34	74	1.5	440	(-) 2.3
N762	-	65	27	29	28	59	1.5	515	(-) 4.6
N765	-	115	31	34	32	81	1.5	370	(-) 0.3
N774	-	72	29	30	29	63	1.5	490	(-) 3.8

Sieve Residue(%max):#35 mesh=0.001 #325 mesh=0.05: Ash(%max) =1.0
ITRB=Industry Tint Reference Black:IRB=Industry Reference Black:24M4DBP=Carbon Black compressed 4 times at 24,000 psi before determining DBP absorption: Modulus determination based on ASTM NR recipe(D3192)

THE GENERAL APPLICATION CHART OF THE ASTM GRADES

(However the specific application depends on the specific need of the end products the appropriate grade has to be selected).

APPLICATION BASED CARBON BLACK SELECTION GUIDE RUBBER APPLICATIONS

	Applications	Hard Grades																	Soft Grades										Speciality Grades							
		N 110	N 115	N 121	N 134	N 220	N 299	N 231	N 234	ACB 200P	N 326	N 326 EG	N 330	N 339	N 347	N 351	N 375	TBL 303	N 539	N 550	ACB 5000	ACB 600	N 650	N 660	N 683	N 762	N 765	N 772	N 774	N 220 P	ACB 5000P	JC 300P	N 539P	N 550P	N 550GL	N 660 P	N 700P Series
General	Adhesives/ Sealants												L											L													
	Elastic Threads, Rubber Bands etc.					S							L							L				S													
	Rubber Rollers					L							L							L		S		L		S		S	S								
	Rubber Liner												L							L		S		S				S	S								R
Retread	Retread Rubber	S	S	S	S	L	S		S/R				L	L	S		S																				
	OTR Retread Rubber					S					S/R		L	S																							
	Cushion Gum																			L				L													
Extruded	Rubber Tubes																			L			S	L									R		R	
	Cable insulation (Rubber)																			L				S									R	R		
	Cable Jacketing (Rubber)					L		R		S/R		S	L							L																
	Auto Profile - Solid &Sponge																			L	S			S	S						R			L/R	L/R	S/R	
	Construction Profile																			L	S			S	S									L/R		S/R	
	Weatherstrip																		S	L			S								R		S/R	L/R	L/R		
	Fuel Tubes																			L											R			L/R	L/R		
	High Pressure Hoses												S							L		S		L					S					L/R	L/R	S/R	R
	Hose Inner Liner																			L				S							R			L/R	L/R		
	Radiator Hoses																			L				S							R			L/R	L/R		
	Medium Pressure Rubber Hoses										S		L			S				L		S	S	S			S	L	S					S/R		S/R	S/R
	Automotive Belts, V-Belts, Timing Belts					L					S		L						S	L		S	S			S	S	L	S								
Calendared	Conveyor Belts Cover					L	S		S				L	L		S	S			S		S		S													
	Rubber Coated Fabrics												L							S		S		L					S								
	Roofing / Rubber Sheeting												L							L		S		L				S	S								
Moulded	Dock Fenders					S							L							L		S		S													
	O-Rings and Gaskets, Rubber Seals					S							L							L	S			L		S		L	L	S/R		R	S/R	R		R	R
	Diaphragms												L							L								S	S	R		R			R		R
	Suspension Bushes, Hangers					L							L							L				S				S	S								
	Rubber Bellows & Grommets					S							L							S		S		L				L	L								
	Shoe Soles					S					S		L									S		L		S	S										
	Engine Mounting												L							L																	
	Rubber Matting												L									S		L													
	Rubber Flaps					L							L																								
	Anti-Vibration Dampers												L							L																	
	General MRG					S	S	S	S		S		L	S	S	S	S	S	S	L		S	S	L	S	S	S	L	L								
	Elastomeric Rubber Pad for Railways																						S	S			L									

Note :- These recommendations are for General applications. The selection of Carbon black grade may vary depending on Processing & End-use application. We request to consult us for suitable grade/s in more specific usages.

Description	L	Large Usage	S	Small Usage	S/R	Small usage but strongly recommended	R	Strongly Recommended	L/R	Large usage also strongly recommended

THE CHOICE OF THE CARBON BLACK FOR THE NICHE APPLICATION

DEPENDS MAINLY ON THE FOLLOWING PROPERTIES OF THE BLACK AND ITS INFLUENCE and also on the GRID percentage (Lower the Grid level {Here it represents the values in the 325 mesh} better the end quality).

CARBON BLACK CHARACTERISTICS	EFFECT OF SURFACE AREA		EFFECT OF STRUCTURE	
	SMALLER S.A.	LARGER S.A.	LOW STRUCTURE	HIGH STRUCTURE
GLOSS	NO SIGNIFICANT EFFECT	NO SIGNIFICANT EFFECCT	HIGHER	LOWER
MASSTONE	GRAYER	DARKER	DARKER	GRAYER
UNDERTONE	BLUER	BROWNER	BROWNER	BLUER
TINTING STRENGTH	WEAKER	STRONGER	NO SIGNIFICANT EFFECT	NO SIGNIFICANT EFFECT
ELECTRICAL CONDUCTIVITY	LOWER	HIGHER	LOWER	HIGHER
UV PROTECTION	DECREASES	INCREASES	NO SIGNIFICANT EFFECT	NO SIGNIFICANT EFFECT

EFFECT OF SURFACE MODIFICATION

All carbon blacks have chemisorbed oxygen complexes on their surfaces to varying degrees depends on the manufacturing conditions. These oxygen absorbing groups are collectively referred to as volatile content.

An untreated black has the volatile content between 0.5 & 1.5% and pH is>6.0 and the oxidized black has the volatile content between 3 & 10%, having pH <6.0

Oxidised blacks are less conductive than the unoxidised blacks of the same surface area and structure.

GLOSSARY OF TERMS IN CARBON BLACK

STRUCTURE

The term “Structure” describes the complex interconnectedness of primary particles within the aggregates. High Structure Black is characterized by aggregates composed of may primary particles with considerable branching & chaining. Low Structure Black is characterized by the minimized extent of aggregation. Higher structure creates void space within the aggregate and this will influence the rheological properties like viscosity in liquid media.

GLOSS

Gloss refers to the shininess or luster of a product. Carbon Black does not add gloss, it detracts from gloss. Therefore it is important to use the carbon black that detracts as little as possible. For Eg. High structure grades detract more from the gloss of a finished product than a low structure grades.

MASSTONE

Masstone referes to the degree of jetness that carbon black imparts to a product. The effect of structure on masstone is slight, higher structure blacks ten to be slightly lighter than the low structure black. Whereas High Surface area imparts more jetness.

UNDERTONES

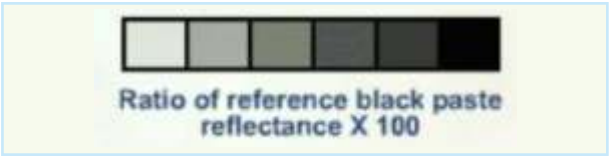
Undertones refer to the subdued colours visible through the predominant black colour of the carbon black.

Carbon black grades with a larger surface area per unit weight(smaller primary particle size) absorb more light expecially on the blue end of the spectrum, leaving a brown undertone more visible. i.e. brown undertone, where as smaller surface area grades absorb less light and reflect more blue colour.

On the influence of structure, higher structure blacks tend to be slightly bluer in tone than low structure blacks of equal surface area.

TINTING STRENGTH

Tinting strength is an industry test used for the classification of carbon blacks adopted by ASTM. It is closely related to the surface area and decrease with increasing particle size.



UV PROTECTION

UV protection stems from the carbon black's ability to absorb ultraviolet radiation as well as its back scattering efficiency.

Back scattering efficiency is the ability of primary particles to redirect light ot other absorbing primary particles or back in the direction of the light source.

Smaller particle size and larger surface area provide better UV protection.

ELECTRICAL CONDUCTIVITY

Carbon black is a semiconductor as it exhibits the ability to conduct electrons with reasonably low resistance. Smaller primary particles have higher electrical conductivity than larger primary particles i.e. larger surface area conducts better, also Higher structure blacks exhibit higher electrical conductivity. Also untreated surface carbons have higher electrical conductivity.

APPLICATION BASED CARBON BLACK SELECTION GUIDE INKS, COATINGS & OTHERS

Applications		Hard Grades										Soft Grades			Speciality Grades			
		N 220	N 231	ACB 2000	N 326	N 326 EG	N 330	JC 300	ACB 1000	TBL 303	TBL 310	N 660	N 774	TBL 53	N 220P	BC 1001	N 326P	JC 300P
Offset Inks	News Web Offset - Economical				L/R	R	L/R	R	S/R	R	R				R	R	R	R
	News Web Offset - Premium				L	R	L	R	S/R	R	R			S/R	R	R	R	
	Sheet fed Offset	S			L	R	L	R	S/R	R	R				R	R	R	R
Gravure Inks	Gravure - Poly Urethane based																	
	Gravure - Vinyl based																	
	Gravure - Nitro Cellulose based																	
	Gravure - Polyamide based				S	R		R	R							R		R
Flexo Inks	Flexo - Solvent based	S		R	S	R	S	R	R	R	R				R	R	R	R
	Flexo - Water based	S		R	S	R	L/R	R	R	R	R				R	R	R	R
Screen Inks	Screen Printing Inks	S		R	S	R	S	R	R	R	R					R	R	R
	Metal Decorative	S		R	S	R			R		R				R	R	R	R
COATINGS	**Architectural Coatings**	S	S	R	L	R	L	R	R	R	R	S			R	R	R	R
	Decorative Coatings	S	S	R	L	R	L	R	R	R	R	S			R	R	R	R
	Industrial - Protective	S		R					R							R		R
	Industrial - Marine																	
	Automotive Finishes																	
	Automotive Re-Finishes																	
	Aqueous Dispersions	S	R		L/R	R	L/R	S/R		R	R		S/R		R		S/R	S/R
OTHERS	Tire Coating	L/R		R											R			
	Carbon Paper, Toners etc.				S	S					S							

Note :- These recommendations are for General applications. Selection may vary depending on Processing, Varnish & end-use application. We advice to consult us for specific application.

Description							
	S	Small Usage	R	Recommended	L	Large Usage
	S/R	Small usage & Recommended	L/R	Large Usage & Recommended		

APPLICATION BASED CARBON BLACK SELECTION GUIDE
PLASTIC APPLICATIONS

	Applications	Hard Grades						Soft Grades						Speciality Grades						
		N 220	ACB 200P	N 326	N 326 EG	N 330	JC 300	N 550	N 660	N 683	N 762	N 772	N 774	N 220P	N 326P	JC 300P	N 550P	N 550GL	N 660P	N 700P series
Films	General Purpose Films in Packaging & Agricultural application	L		S	S	L	R	S	S	S	S	S	S	R	R	R	S/R		S/R	S/R
	Good Weathering Resistance & High Color Films	L	S/R			S								R						
	Terpaulins	L	S			S								R		R				
	Geomembranes	L												R						
	Trash Bags	S				L														
Moulding	Automotive moulding	L				L	R	S	S					R		R			S/R	
	Industrial moulding, Injection Moulding	L			S	L	R	S	S/R					R		R			S/R	
	Rational Moulding	L				L/R	R	S	L/R					R		R			S/R	
	Blow Moulding	L				L/R	R	S	S/R					R		R	R		S/R	
Pipes	Specification Pipes including Pressure Pipes	L	S			L	R							R		R				
	Drip Irrigation Laterals, Conduits	L	S			L	R							R		R				
	Drinking Water Pipes	L	S/R			L								R		R				
	Non-Specified Pipes	S				L					S	S	S							R
Wire & Cables	Wire & Cable Jacketing	L				L								R		R				
	ESD, Semicon													R				R		

Note :- These recommendations are for General applications. The selection of Carbon black grade may vary depending on Processing & end-use application. We advice to consult us for suitable grade in special usages.

Description							
	L	Large Usage	S	Small Usage	R	Strongly Recommended	
	S/R	Small usage/ strongly recommended			L/R	Large Usage & Recommended	

PLEASE NOTE : ALL THE ABOVE GRADES ARE BEING MANUFACTURED BY
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