

ELLOR® GRAPHITE FOR ELECTRICAL DISCHARGE MACHINING

A complete range of grades, from universal to micro-grain graphite.



ISO 9001: 2000 | ISO 14001

ELLOR®+18

ELLOR® graphite grades for Electrical Discharge Machining...

...to suit a wide range of applications

ELLOR® DS4

ELLOR®+40



ELLOR®+50

S4



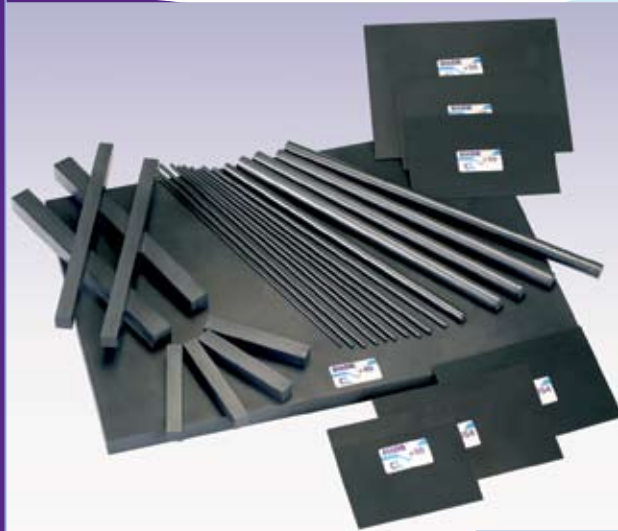
ELLOR®+20

ELLOR®+20

ELLOR®+50

ELLOR® graphite grades for Electrical Discharge Machining

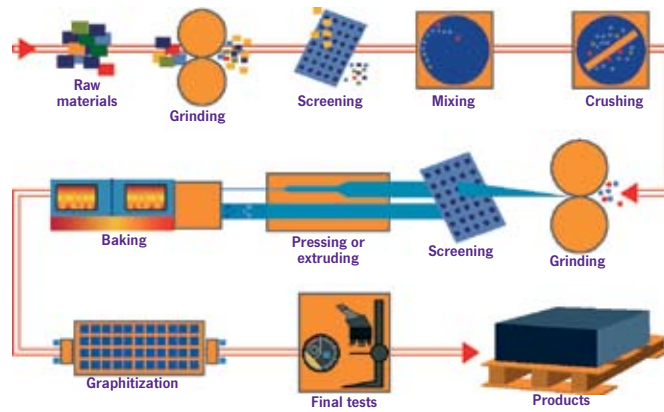
A large range of standard electrodes



ELLOR® GRAPHITE = GAIN IN PRODUCTIVITY

- # Using ELLOR® graphite means time savings, up to 40 % in roughing mode.
- # With same current density, metal removal turns from 600 mm³ / min with copper to 1,200 mm³ / min with ELLOR® graphite.
- # The stability of ELLOR® graphite grades permits the machining of thin ribs.

Graphite manufacturing



Graphite advantages

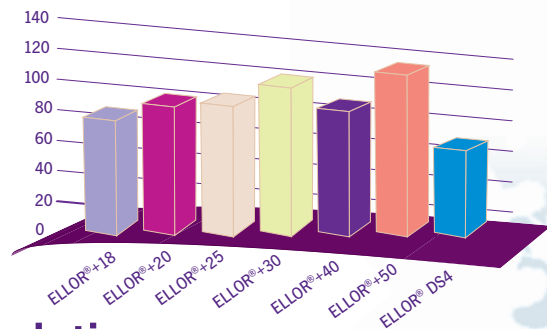
Graphite has many advantages that have made it the material most widely used for EDM electrodes.

- ✦ It is **easy to machine**.
- ✦ It is very resistant to **thermal shock**.
- ✦ It has a **low coefficient of thermal expansion** (3 times lower than copper) which guarantees stability of electrode geometry during EDM.
- ✦ It is available in **large blocks**.
- ✦ It does not melt, but goes directly from the **solid** state to the **gaseous at 3,400°C**, which reduces wear.
- ✦ Its **density** is 5 times **lower** than that of copper, which results in lighter electrodes.
- ✦ It provides a higher **metal removal rate** than copper with less wear.
- ✦ It has the unique characteristic that the **wear ratio** tends to decrease as the peak current increases.

Grade machinability

Machinability Index

Described how difficult is the electrode to machine ELLOR®+25 equals 100 as a reference



Machining recommendations

MILLING	Speed m/min	Feed rate (per tooth) mm		
Roughing	800~1000	0,1~0,8		
Finish	1000	< 0,09		
TURNING	Speed m/min	Advance mm per revolution (rpm)	Depth of cutting in mm	
Roughing	100~250	0,3~0,45	5~19	
Finish	200~450	0,06~0,15	0,1~0,5	
RECTIFICATION	Speed m/min	Advance mm / min		
	1000~2300	150~800	< 3	
SAWING	Speed m/min	Advance mm / min		
	350~500	300~400		

(We recommend dry machining with the use of a dust collector).

Tools

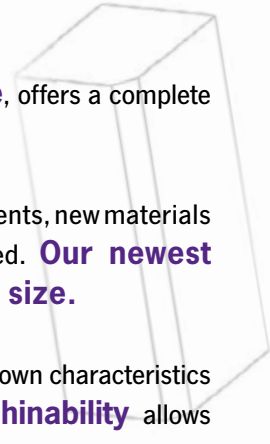
Micro-grain tungsten carbide, diamond,...

Unique graphite grades with enhanced EDM performance

CARBONE LORRAINE, a worldwide leader in iso-molded graphite, offers a complete range of graphite grades to suit any EDM applications.

In order to satisfy customers and meet their unique specifications and requirements, new materials with improved properties and performance are constantly being developed. **Our newest ELLOR® graphite grades now benefit from much finer grain size.**

Ranging from universal to micro-grain graphite each grade has its own characteristics and offer uniform quality and structural consistency. Their **excellent machinability** allows detailed finishing electrodes to be produced.



Roughing graphite ideal for high metal removal

Maximum block size: 308 x 620 x 1,830 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "L"	Shore	MPa	$\mu\Omega.cm$	μm
1.76	98	55	45	1,370	12



Universal graphite excellent Quality / Performance ratio

Maximum block size: 308 x 620 x 1,830 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1.80	70	65	52	1,240	11



High quality universal graphite - Good surface finish

Maximum block size: 308 x 620 x 1,830 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1.82	75	65	55	1,220	9

Unique graphite grades with enhanced EDM performance

High density fine grain graphite - Low electrode wear

Maximum block size: 308 x 620 x 915 mm

ELLOR®+30

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1.84	< 95	< 80	65	1,370	8

Ultra fine grain graphite - Low electrode wear, fine detail

Maximum block size: 308 x 620 x 1,830 mm

ELLOR®+40

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1.78	75	60	60	1,270	7

High density ultra fine grain graphite - Lowest electrode wear

Maximum block size: 305 x 620 x 915 mm

ELLOR®+50

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1.86	95	80	76	1,270	5

Ultra fine grain graphite - Ultimate precision and EDM performance

Maximum block size: 102 x 305 x 305 mm

ELLOR® DS4

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1.82	90	70	93	1,650	4

ELLOR® graphites grades are in conformity with the RoHS directive ("restriction of the use of certain hazardous substances in electrical and electronic equipment").

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Use recommendations

Good EDM results require not only the proper selection of EDM material, but also proper machine settings, such as peak current, on time, off time, gap size, electrode polarity and most importantly the flushing conditions.

Due to the many variations in work piece geometry, the EDM machine **setting conditions** for new geometries are mainly selected from **experience** and fine tuned as the work progresses. In effect, the **geometry** of the piece being produced will determine **the right selection**. There is not only one proper combination of settings for each grade of graphite, but in reality as many different setting combinations as the number of pieces that can be manufactured by EDM.



That is why experience in EDM is the number one factor of success. Our technical team can give the **basic support needed** to help you understand the effects of these different setting parameters. This information will help you **determine what parameters**.

Surface finish achievable on steel with ELLOR® graphite:

	Finishing mode					Intermediate				Roughing		
	▼▼▼					▼▼				▼		
VDI 3400	12	15	18	21	24	27	30	33	36	39	42	45
Ra μm	0.40	0.56	0.80	1.12	1.60	2.24	3.15	4.50	6.30	9.00	12.50	18.00
Ra μim	16	22	31	44	63	88	124	177	248	354	492	709
								ELLOR®+18				
								ELLOR®+20				
							ELLOR®+25					
						ELLOR®+30						
					ELLOR®+40							
	ELLOR®+50 & DS4											

Recommended grades:

	ELLOR®+18	ELLOR®+20	ELLOR®+25	ELLOR®+30	ELLOR®+40	ELLOR®+50	ELLOR®DS4
Wire EDM		○	●	●	●	●	●
Deep holes			●	●	●	●	●
Fine ribs			○	●	●	●	●
Steel	●	●	●	●	●	●	●
Refractory steel	○	○	●	●	●	●	●
Titanium, molybdenum, copper			○	●	○	●	●
Tungsten Carbide				●	○	●	●

- Applicable
- Suitable

Maximum current density per material:

Electrode Material	Polarity	Maximum Current Density	Maximum current
Graphite	+	10 A/cm²	400 A
Graphite	-	7 A/cm²	25 A
Copper	+	15 A/cm²	50 A
Cu-Gr	+	13 A/cm²	
Cu-W	-/+	10 A/cm²	25 A



CUSTOMER-ORIENTED INTERNATIONAL NETWORK



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PARTNER IN INNOVATION

Carbone Lorraine harnesses prime expertise in industrial applications to deliver innovative solutions – involving graphite, other high-performance materials, and key components for electric motors and electronic equipment – for many high-technology markets

As world number-one in its main business specialities, Carbone Lorraine fields an extensive industrial and commercial network covering around 40 countries, working hand in hand with its clients to pursue permanent innovation through a broad range of top-class products and services.



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