

ELLOR® GRAPHITE
FOR ELECTRICAL
DISCHARGE MACHINING

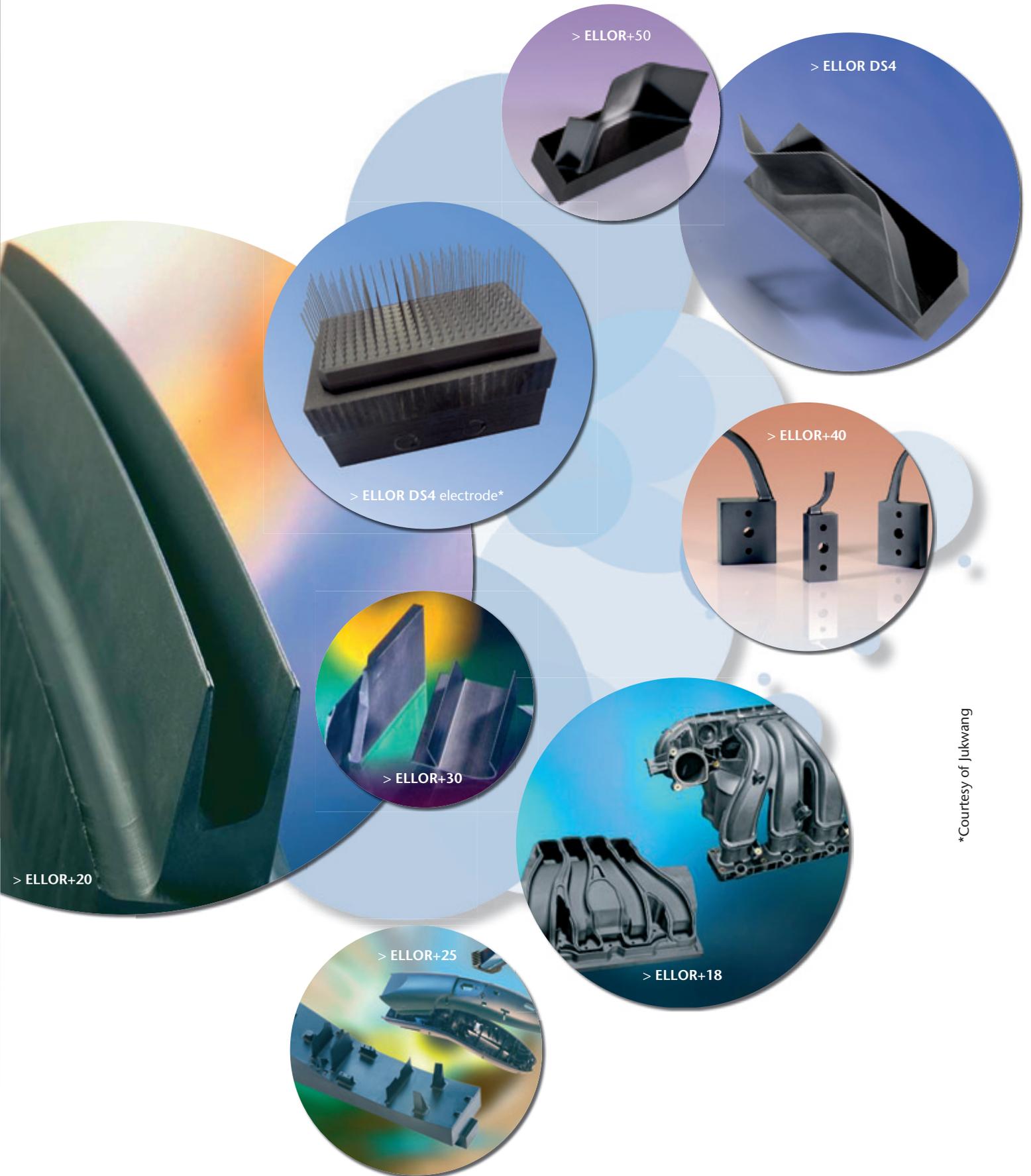
A complete range
of grades, from universal
to micro-grain graphite



MERSEN

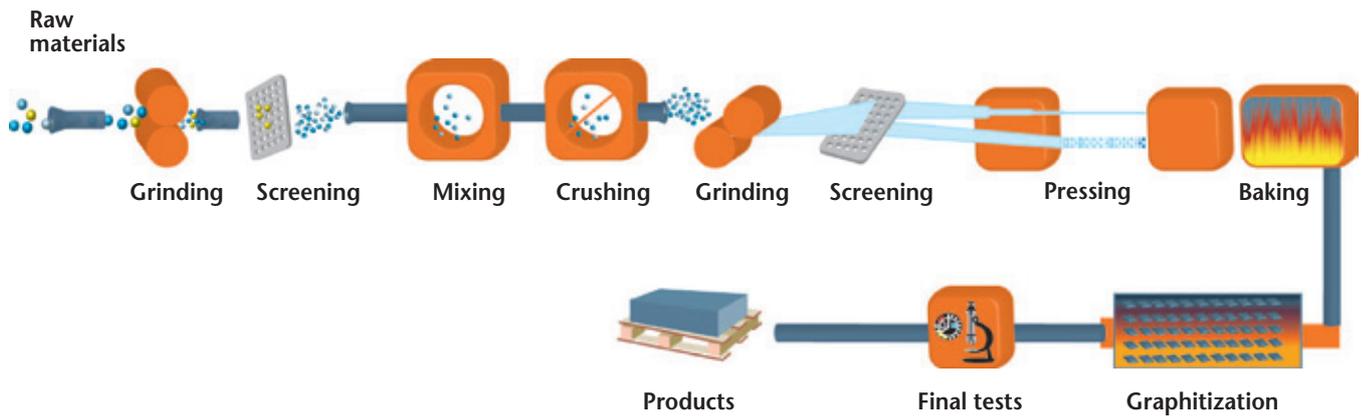


ELLOR® GRAPHITE GRADES FOR ELECTRICAL DISCHARGE MACHINING... ...to suit a wide range of applications



*Courtesy of Jukwang

GRAPHITE MANUFACTURING



GRAPHITE ADVANTAGES

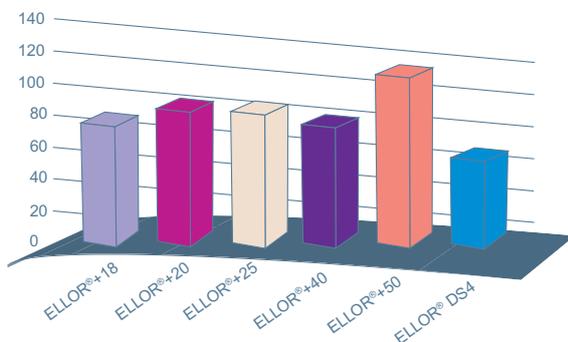
Graphite has many advantages that have made it the material most widely used for EDM electrodes.

- > 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.

The index describes how difficult it is to machine the electrode. ELLOR®+25 equals 100 as a reference.

GRADE MACHINABILITY



MACHINING RECOMMENDATIONS

MILLING	Speed m/min	Feed rate (per tooth) mm	(We recommend dry machining with the use of a dust collector).
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	
	100~2300	150~800	<3
SAWING	Speed m/min	Advance mm/min	
	300~500	300~400	

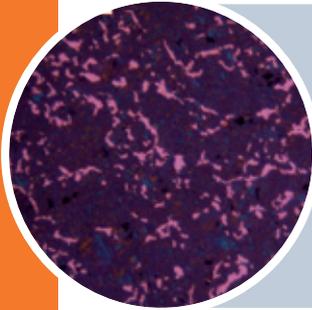
TOOLS

Micro-grain tungsten carbide, diamond...

UNIQUE GRAPHITE GRADES WITH ENHANCED EDM PERFORMANCE

MERSEN, 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.

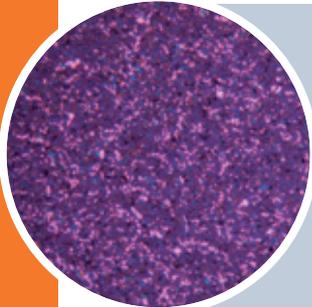
“COPPER IMPREGNATED GRADES”



ELLOR®20C

Universal copper impregnated graphite - high metal removal rate
Maximum block size: 165 x 200 x 308 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
2,60	75	70	80	227	11

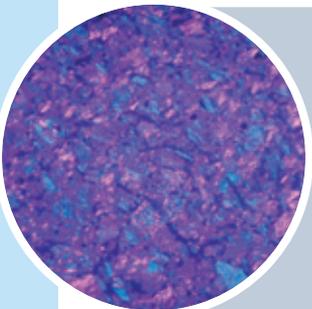


ELLOR®DS4C

Ultra-fine grain copper impregnated graphite - exceptional EDM performance and precision
Maximum block size: 51 x 203 x 305 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
2,85	110	75	117	224	4

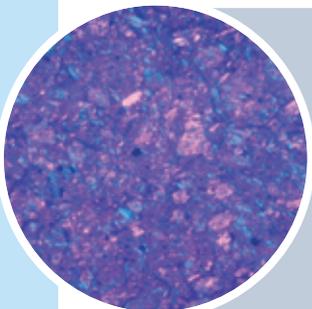
“UNIVERSAL GRADES”



ELLOR®+18

Roughing graphite - ideal for high metal removal rate
Maximum block size: 308 x 620 x 1,830 mm

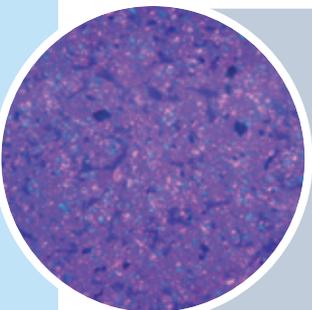
Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "L"	Shore	MPa	$\mu\Omega.cm$	μm
1,78	98	55	45	1 370	12



ELLOR®+20

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
1,81	72	65	52	1 240	11



ELLOR®+25

High quality universal graphite - good surface finish
Maximum block size: 308 x 620 x 1,830 mm

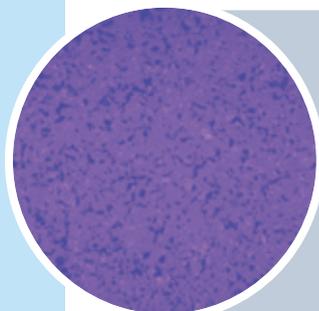
Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	$\mu\Omega.cm$	μm
1,83	80	65	55	1 220	9

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 offers uniform quality and structural consistency.

Excellent machinability allows detailed finishing electrodes to be produced.

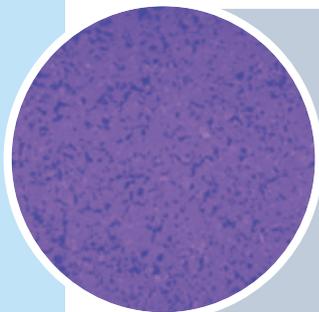
“FINE GRAIN GRADES”



ELLOR®+40

Fine grain graphite - low electrode wear, fine details
 Maximum block size: 300 x 600 x 915 mm

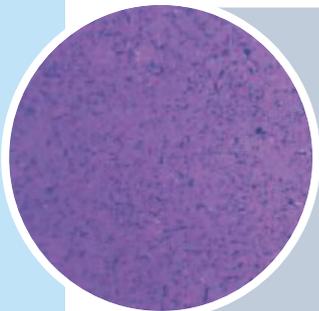
Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	μΩ.cm	μm
1,78	75	60	60	1 270	7



ELLOR®+30

Fine grain graphite - low electrode wear, fine details
 Maximum block size: 308 x 620 x 915 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	μΩ.cm	μm
1,84	< 95	< 80	65	1 220	8

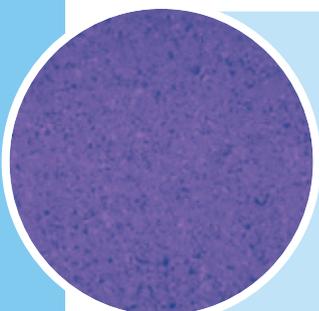


ELLOR®+50

High density fine grain graphite - very low electrode wear
 Maximum block size: 305 x 305 x 915 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	μΩ.cm	μm
1,86	95	80	76	1 270	5

“ULTRA-FINE GRAIN GRADE”



ELLOR®DS4

Ultra-fine grain graphite - exceptional EDM performance and precision
 Maximum block size: 102 x 305 x 305 mm

Density	Hardness	Hardness	Flexural Strength	Electrical Resistivity	Average Grain Size
Unit	Rockwell "H"	Shore	MPa	μΩ.cm	μm
1,88	95	70	90	1 370	4

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Our materials are in conformity with the RoHS-Directive (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment).

Besides Mersen guarantees the application of the European Community REACH-Regulation (Registration, Evaluation, Authorisation and Restriction of Chemical substances) to all its plants located in Europe.

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 the proper 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

Recommended grades:

	ELLOR®+18	ELLOR®+20	ELLOR®+25	ELLOR®+40	ELLOR®+30	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:

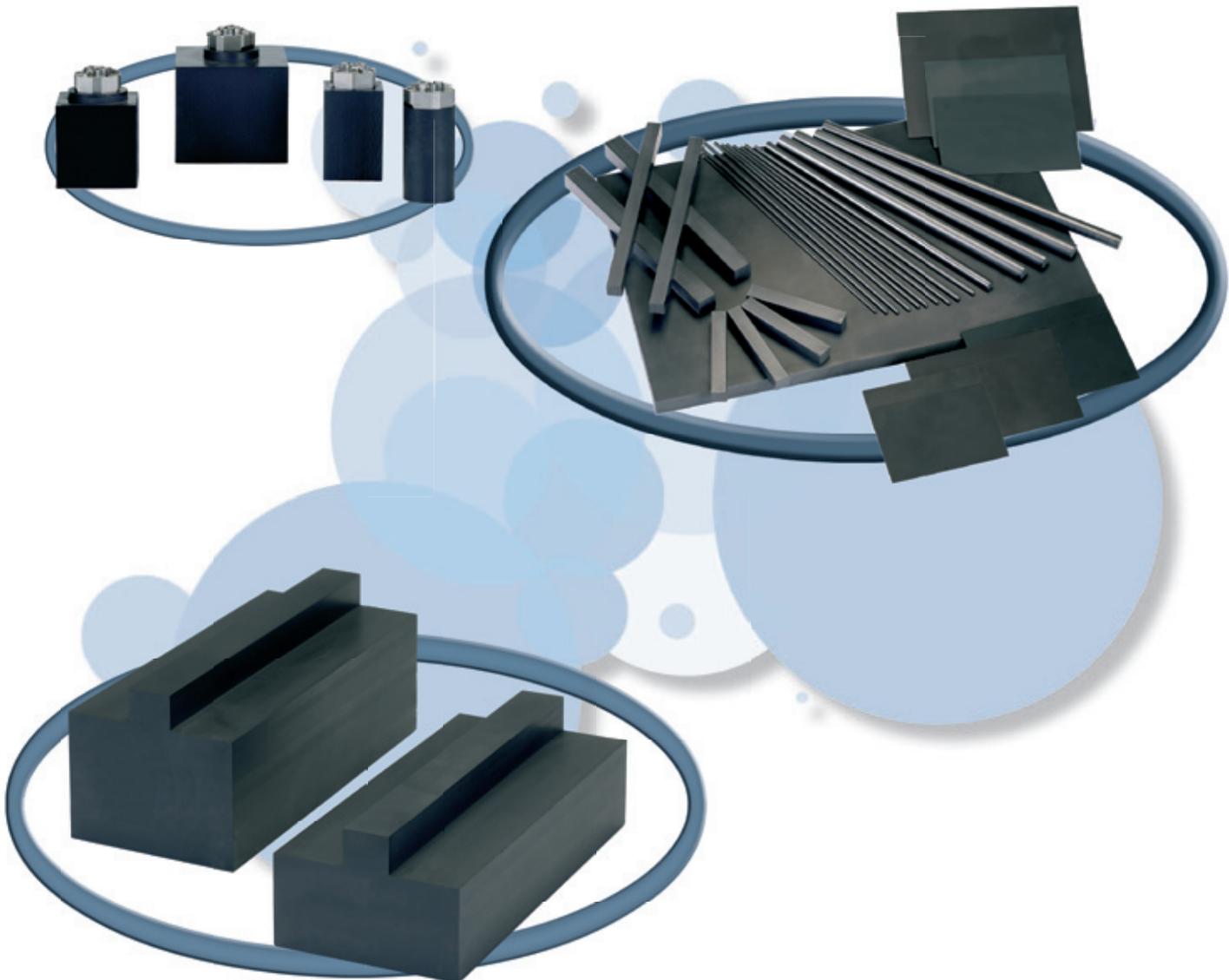
Electrode material	Polarity	Maximum current density	Maximum current
Graphite	+	10 A/cm ²	400 A
Graphite	-	7 A/cm ²	25 A
Copper	+	15 A/cm ²	50 A
Cu-Gr	+	13 A/cm ²	
Cu-W	-/+	10 A/cm ²	25 A

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.





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GLOBAL EXPERT
in electrical specialties
and graphite-based materials.

A GLOBAL PLAYER

Global Expert in electrical specialties and graphite-based materials, Mersen designs innovative solutions to address its clients specific needs to enable them

to optimize their manufacturing process in sectors such as energy, transportation, electronics, chemical, pharmaceutical and process industries.

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