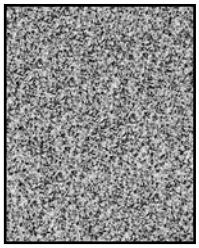
POCO GRAPHITE

An Entegris Company

POCO EDM GRAPHITE SELECTION GUIDE

ANGSTROFINE GRAPHITE

EDM-AF5®



POCO's EDM-AF5 is the premier graphite electrode material available on the market today with an average particle size of less than one micron. This particle structure gives EDM-AF5 superior strength, provides for fine surface finish (7µinR_a), gives excellent metal removal rate, and high resistance to wear.

Typical Value

Average Particle Size: <1 micron

Flexural Strength: 14,500 psi (1,019 kg/cm^2)

Compressive Strength: 22,100 psi (1,554 kg/cm^2)

Hardness: 83 Shore

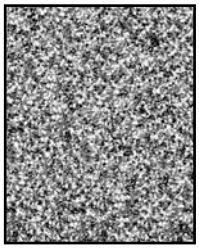
Electrical Resistivity: 850 µΩin (21.6 µΩm)

Applications

- Fine detailed electrodes for engraving
- Hard to machine detail
- Delicate and fragile electrodes
- Various type threading electrodes
- Jobs requiring fine surface finishes
- Intricate molds and dies

COPPER ULTRAFINE

EDM-C3®



POCO's EDM-C3 is a high quality graphite infiltrated with copper, recommended where speed, wear, and surface finish are important. Unequalled for fragile electrodes, many EDM'ers choose this grade to compensate for operator inexperience or where poor flushing conditions exists.

Typical Value

Average Particle Size: <5 microns

Flexural Strength: 20,300 psi (1,427 kg/cm^2)

Compressive Strength: 28,350 psi (1,993 kg/cm^2)

Hardness: 66 Shore

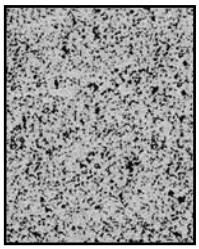
Electrical Resistivity: 127 µΩin (3.2 µΩm)

Applications

- Fine detailed electrodes where strength is critical
- Threading electrodes
- Aerospace applications
- Plastic injection molds
- Machining of carbide
- Small hole drilling

ULTRAFINE GRAPHITE

EDM-4®



POCO's EDM-4 is the premier offering in the Ultrafine grain classification. This highly isotropic grade combines extraordinary strength with moderate hardness, yielding superior electrode fabrication characteristics. EDM-4 has superior EDM performance characteristics for metal removal rates, wear and surface finish.

Typical Value

Average Particle Size: <4 microns

Flexural Strength: 17,500 psi (1,230 kg/cm^2)

Compressive Strength: 21,500 psi (1,511 kg/cm^2)

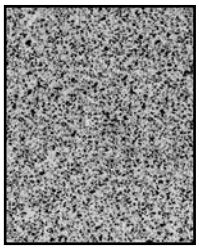
Hardness: 76 Shore

Electrical Resistivity: 500 µΩin (12.7 µΩm)

Applications

- EDMing of fine detailed electrodes requiring excellent surface finishes
- Wire cut electrodes
- Plastic injection molds

EDM-3®



POCO's EDM-3 is an isotropic Ultrafine grain graphite which offers high strength with outstanding wear and fine surface finish characteristics easily machined to thicknesses of 0.1mm or less.

Typical Value

Average Particle Size: <5 microns

Flexural Strength: 13,300 psi (935 kg/cm^2)

Compressive Strength: 18,100 psi (1,273 kg/cm^2)

Hardness: 73 Shore

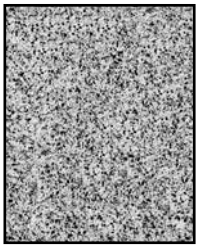
Electrical Resistivity: 615 µΩin (15.6 µΩm)

Applications

- EDMing of fine detailed electrodes
- Punch and die sets
- Plastic injection molds
- Threading electrodes
- Use in aerospace metal cutting

ULTRAFINE GRAPHITE

EDM-2®



POCO's EDM-2 is an isotropic Ultrafine grain graphite with high strength and good wear characteristics. Recommended for use on detailed electrodes, where speed, fine finish and resistance to wear is desired.

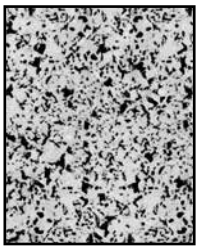
Typical Value
Average Particle Size: <5 microns
Flexural Strength: 11,200 psi (787 kg/cm^2)
Compressive Strength: 16,900 psi (1,188 kg/cm^2)
Hardness: 71 Shore
Electrical Resistivity: 620 µΩin (16 µΩm)

Applications

- IC Molds
- Aerospace applications
- Fine-detailed electrodes
- Minimum-taper-cavities
- Blind cavity work
- Threading electrode

SUPERFINE GRAPHITE

EDM-200®



POCO's EDM-200 is an isotropic Superfine particle graphite providing good strength, surface finish, and wear resistance. Moderately priced, EDM-200 provides excellent repeatability from electrode to electrode and from job to job.

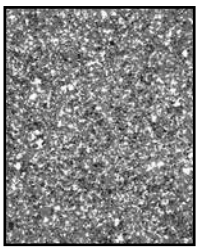
Typical Value
Average Particle Size: 10 microns
Flexural Strength: 9,000 psi (635 kg/cm^2)
Compressive Strength: 15,500 psi (1,075 kg/cm^2)
Hardness: 68 Shore
Electrical Resistivity: 580 µΩin (14.7 µΩm)

Applications

- Structural ribs
- Roughing or finishing electrodes
- Large featured mold
- High strength large electrodes

COPPER SUPERFINE

EDM-C200®



POCO's EDM-C200 is a Superfine graphite infiltrated with copper which offers excellent metal removal rates and good wear resistance. EDM-C200 provides improved cutting stability in poor flushing conditions. EDM-C200 is an excellent material for cutting aerospace alloys.

Typical Value
Average Particle Size: 10 microns
Flexural Strength: 12,100 psi (851 kg/cm^2)
Compressive Strength: 23,200 psi (1,631 kg/cm^2)
Hardness: 62 Shore
Electrical Resistivity: 114 µΩin (2.9 µΩm)

Applications

- EDMing of fine detailed electrodes requiring excellent surface finishes
- Wire cut electrodes
- Plastic injection molds

CLASSIFICATIONS OF GRAPHITE

Angstrofine	**EDM-AF5**	<1µ	Used where extremely fine detail and critical machining are required.
Ultrafine	**EDM-2** **EDM-3** **EDM-C3** **EDM-4**	1µ-5µ	Used where electrode strength and precision are necessary.
Superfine	**EDM-200** **EDM-C200**	6µ-10µ	Used in large molds where detail is maintained and wear is an important criterion.

Key Factors of Electrode Selection

EDM has grown up. EDM has taken its place as a proven, precision technology, chosen for what it can do, rather than what conventional machining can't do. EDM machine technology has spawned a world of new applications wherein increased importance is placed on the graphite electrode material utilized.

While there are many methods used to determine the right material for a job, we believe there are five factors that mean the difference between success and failure, profit and loss.

Metal Removal Rate (MRR)

Metal removal rate is usually expressed as cubic millimeters per hour (mm^3/hr) or cubic inches per hour (in^3/hr), but in fact could just as realistically be expressed as $/hr. Achieving an efficient MRR is not simply a matter of the right machine settings. It also involves direct energy dissipated in the EDM process. Graphite is generally much more efficient than metallic electrodes, however metal removal rates vary widely between graphite types. With the proper electrode material/work metal/application combination MRR can be maximized.

Wear Resistance (WR)

There are four types of wear: volumetric, corner, end, and side. Of the four, we believe that corner wear is the most important since the contours of the final cut are determined by the electrode's ability to resist the erosion of its corners and edges. It follows that if an electrode can successfully resist erosion at its most vulnerable points, then overall wear will be minimized, and maximum electrode life achieved. Electrode erosion cannot be prevented, but it can be minimized by choosing the proper electrode material/work metal combination and machining at the optimum settings.

The ability of an electrode to produce and maintain detail is directly related to its resistance to wear and its machinability. Minimizing corner wear requires choosing an electrode material that combines high strength with high temperature resistance.

Surface Finish (SF)

Fine surface finish is obtained by a combination of the proper electrode material, good flushing conditions, and the proper power supply settings. High frequency, low power and orbiting produce the best finish, as these conditions produce smaller, less defined craters in the work metal. The final surface finish will be a mirror image of the electrode's surface, so Angstrofine and Ultrafine particle, high strength graphites are the best choices for finishing electrodes.

Machinability

Any machinist who has ever machined graphite is aware that graphite cuts very easily. Simply being easy to machine doesn't necessarily make a material the best choice for an electrode. It must also be strong to resist damage from handling and from the EDM process itself. Strength and small particle size are important so that minimum radii and close tolerances may be achieved. Material hardness is also a factor in graphite machinability, as the harder electrode materials will be more prone to chipping during the machining process.

Material Cost

Electrode material cost generally represents only a small part of the total EDM job cost. What is too often overlooked, however, is that electrode material cost considered outside the total job cost is completely meaningless.

Fabrication time, cutting time, labor, electrode wear - all these factors depend on the electrode material more than on any other factor. Thus it is critical that you know the properties and performance characteristics of the available electrode materials as they affect the work metals you are machining. Only with this data is it possible to make a cost/performance analysis to determine the true cost of an EDM job.

POCO Technical Assistance

If you have a question concerning electrode materials (ours or anyone's), pick up the phone and call the EDM experts. POCO's EDM Technical Service personnel have many years of practical EDM experience and can help you with design, machining, operating parameters, or practically any situation involving electrode management techniques.

- Grade Verification
- Production Problems
- Applications Specialists
- EDM Training

For More Information

POCO EDM sells through distributors only. Please visit www.poco.com and select "How to Buy" to find a distributor near you.

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