



Engineering
Materials

SPECIALTY CARBONS FOR HARD METALS

ENSACO[®]
Carbon Black

TIMREX[®]
Graphite



www.imerys-graphite-and-carbon.com

Imerys Graphite & Carbon

A STRONG COMPANY

Imerys Graphite & Carbon, member of the Imerys Group, is the reference for innovative capability in the field of carbon-powder-based solutions: natural graphite and synthetic graphite powders, conductive carbon blacks, as well as silicon-carbon composites and water dispersions.

High standards in terms of employee health and safety, social behaviour and environmental responsibility are core values of the company, which is capturing opportunities by developing new products and applications, investing in assets & people, and growing its commercial presence worldwide.



500

Employees
Worldwide



40

Countries



5

Industrial Sites



3

R&D
Centers



**Since
1908**

FINANCIAL STRENGTH



Profitable company, part of Imerys, the world leader in mineral-based specialty solutions for industry, listed on the Paris stock exchange

IMERYS GROUP 2018

WORKFORCE	17,800
REVENUE GROWTH	6.8%
OPERATING SITES	230

RELIABLE PARTNER



INNOVATION STRATEGY

- Focused on the market and the Customer's needs

SECURITY OF SUPPLY

- 5 Industrial sites

OUR DRIVING FORCE

- Customer Service

RESPONSIBLE GROWTH



COMMITMENT TO

- Green Technology and Sustainable Development

REDUCTION OF

- CO₂ Footprint

ENGAGEMENT WITH

- Local Communities



VALUE PROPOSITION

We at IMERYS Graphite & Carbon deliver tailormade solutions for Hard Metal applications with superior consistency of key product parameters: Purity, Crystallinity, Particle Size Distribution, Oversize Control.

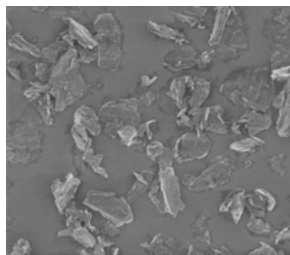
FINAL APPLICATIONS

Cutting tools for machining, mining, foundation drilling, engineered components, carbide drills, turning, milling and metal working tools.

HIGH PURITY SYNTHETIC GRAPHITE

IMERYS Graphite & Carbon has a long term presence in Hard Metals market as supplier of high purity, high consistency Primary Synthetic Graphite Powders.

TIMREX® fine grades, like TIMREX® KS4, KS6, KS15, can be offered with tailored specifications on maximum levels of impurities like Sulphur, Calcium, Silicon, Iron, that are detrimental for Hard Metals manufacturing.



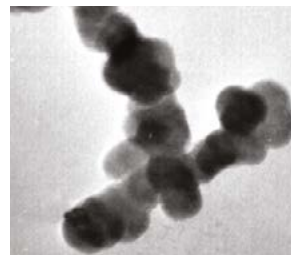
Graphite SEM Image
(TIMREX® KS15)

HIGH STRUCTURE CARBON BLACK

In addition to graphite, we also offer high purity carbon black with high BET. The high reactivity of ENSACO® carbon black makes it particularly suitable for the synthesis of nano-sized WC powders starting from tungsten oxide.



— 20nm
CB primary particle



— 20nm
CB aggregate



— 20nm
CB agglomerates

Carbon Black TEM images (ENSACO® 250G)

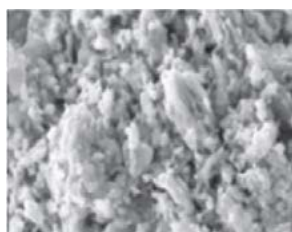
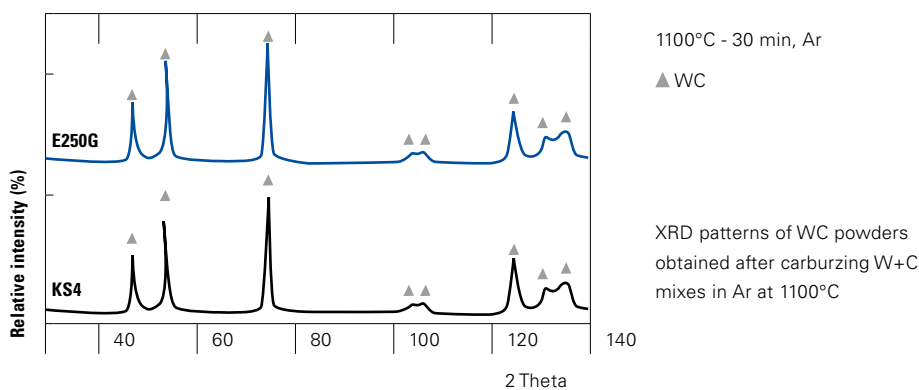
CUSTOMIZABLE SOLUTIONS

KEY REQUIREMENTS	BENEFIT FROM IMERYS	RECOMMENDED GRADE
High Purity	High Purity	Primary Synthetic Graphites: TIMREX® KS15
Small WC grain size	Tailored particle size distribution	
Efficient carburization activity	Carburization at low temperatures	Carbon Black: ENSACO® 250G

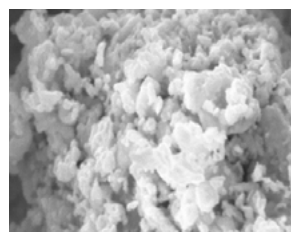
EXPERIMENTAL TESTS

Tungsten metal powder (W) and Tungsten oxide powder (WO_3) have been mixed with different carbon powders (ENSACO® 250G and N991 carbon blacks, KS4 and KS44 graphites) for 2 hours at 300 rpm in a Fritsch Pulverisette planetary mill. Carburization has been performed in a Netzsch DIL402C dilatometer.

WC PRODUCED FROM METALLIC TUNGSTEN POWDER (W)



KS4



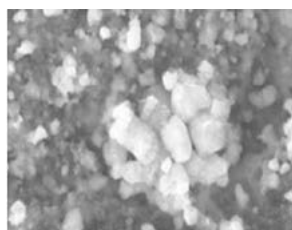
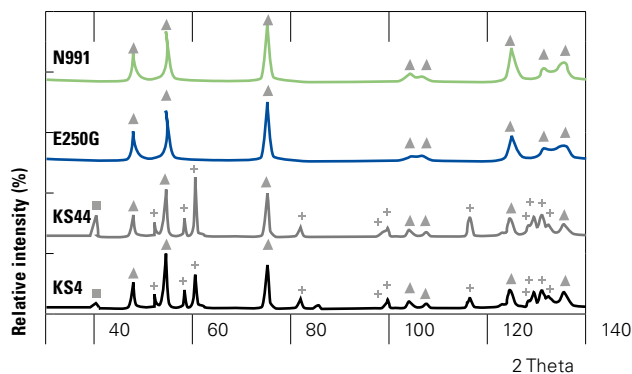
ENSACO® 250 G

SEM patterns of WC powders obtained after carburizing W+C mixes in Ar at 1100°C

- Inert atmospheres are recommended for the synthesis of WC when metal W powders are used as precursors. In these conditions, fine WC powders can be obtained at 1100°C using either graphite or carbon black powders.
- The resulting WC powders consist of agglomerates of submicron particles with irregular platelet morphology.

WC POWDERS OBTAINED FROM W	KS4 - GRAPHITE	ENSACO® 250G - CARBON BLACK
BET (m ² /g)	2.67	2.55
BET grain size (nm)	144	151
Sulphur (ppm)	31	20

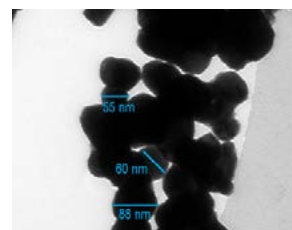
WC PRODUCED FROM TUNGSTEN OXIDE POWDER (WO₃)



ENSACO® 250G



(Competitor Carbon Black) N991



TEM microscopy study of WC from WO₃ and E250G

SEM pictures of WC powders obtained after carburizing W+C mixes in Ar at 1100°C

It is possible to synthesize WC directly from WO₃ powders. In this case, atmospheres containing hydrogen are needed to activate reduction of oxides at lower temperatures, whereas at higher temperatures reduction is promoted by the presence of carbon.

- Carburization reaction takes place at lower temperatures for carbon black (ENSACO® E250G < N991) compared to graphite.
- Carburization in Ar-50%H₂ of mixes containing WO₃+Carbon black is complete at 1100°C, whereas for WO₃+graphite powders complete transformation to WC is achieved at higher temperatures (1300°C).
- The resulting WC powder have spherical morphology, sub-micron particle size and crystalline grain sizes below 30 nm (estimated by XRD).
- The BET surface area is higher compared to WC powders obtained by metallic W. In particular, ENSACO® E250G gives much higher BET values compared to N991, indicating a finer grain size (around 60 nm according to TEM)

WC POWDERS OBTAINED FROM WO ₃	Competitor Carbon Black N991	ENSACO® 250 G
BET (m ² /g)	2.92	6.90
BET grain size (nm)	131	56
Sulphur (ppm)	22	18



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