Monolayer High Strength Metallurgical Graphene HSMG®

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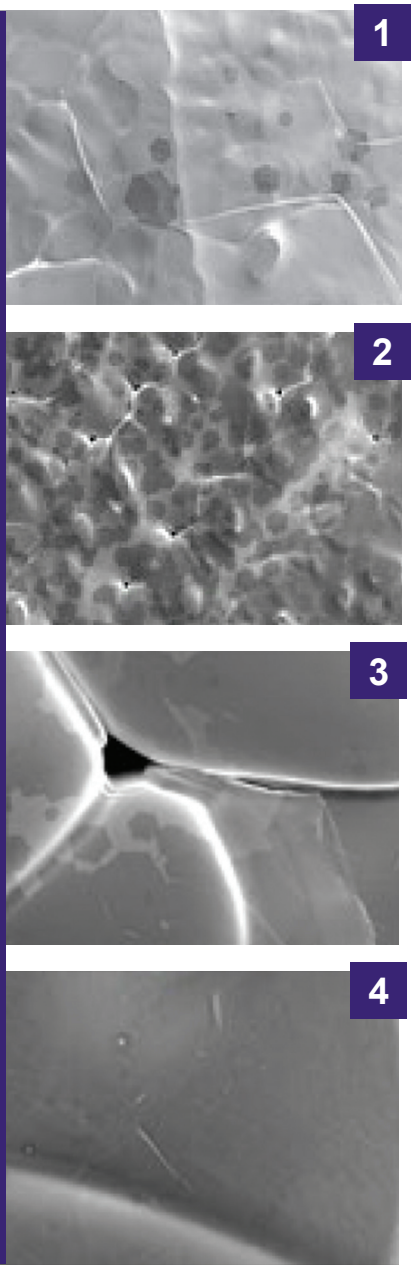
Monolayer High Strength Metallurgical Graphene, HSMG®

06-0345	Monolayer High Strength Metallurgical Graphene, HSMG®, on PMMA (10x10 mm)	1 pc
06-0355	Monolayer High Strength Metallurgical Graphene, HSMG®, on PMMA (25x25 mm)	1 pc
06-0360	Monolayer High Strength Metallurgical Graphene, HSMG®, on PMMA (50x50 mm)	1 pc
06-0365	Monolayer High Strength Metallurgical Graphene, HSMG®, on GLASS (10x10 mm)	1 pc

HSMG® GROWTH PROCESS



Absorption and incorporation of carbon atoms into the crystal structure of the copper matrix occurs during the carburization process. Maximum carbon content is significantly lower for liquid copper matrix than for solid state matrix, therefore, after heating above the melting point, the metal matrix becomes supersaturated with carbon atoms. **HSMG® growth is based on the controlled carbon precipitation from the liquid metal matrix.**

The growth process originates with nucleation of single hexagonal flakes on the metallic substrate. Liquid matrix enables grain rotation and rearrangement during nucleation process which results in larger grain sizes and improved graphene properties. This process is fully controlled and enables the production of graphene sheets with specified number of layers.

STABLE NEGATIVE THERMAL COEFFICIENT

The HSMG® samples show anti-phase temperature resistance relationships during cyclic tests.

HSMG® Temperature coefficient of resistance
$-1.7 \cdot 10^{-3} \div -4 \cdot 10^{-4}$ [1/K]

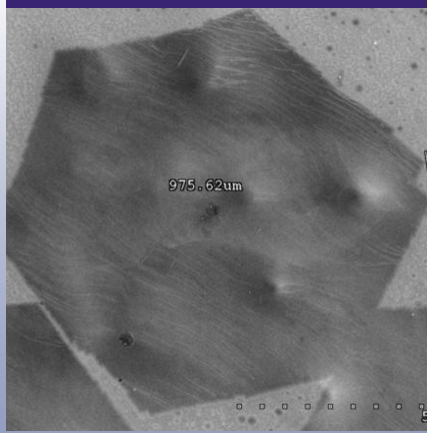
EFFICIENT GAS ABSORPTION

HSMG® shows susceptibility to reversible gas sorption (including selective hydrogen sorption from gas mixture) which enables application of HSMG® as the functional material for future gas sensors.

Nomarski interference contrast image

Grain arrangement during nucleation

SEM



Evaluation of graphene grain size during growth process

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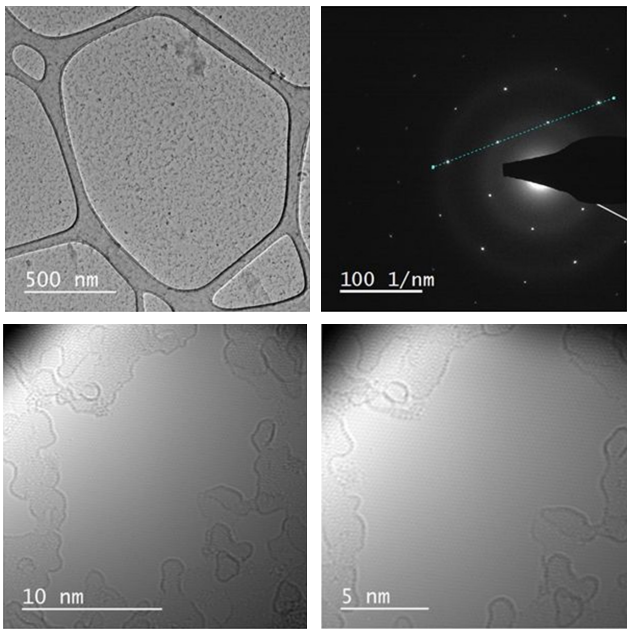
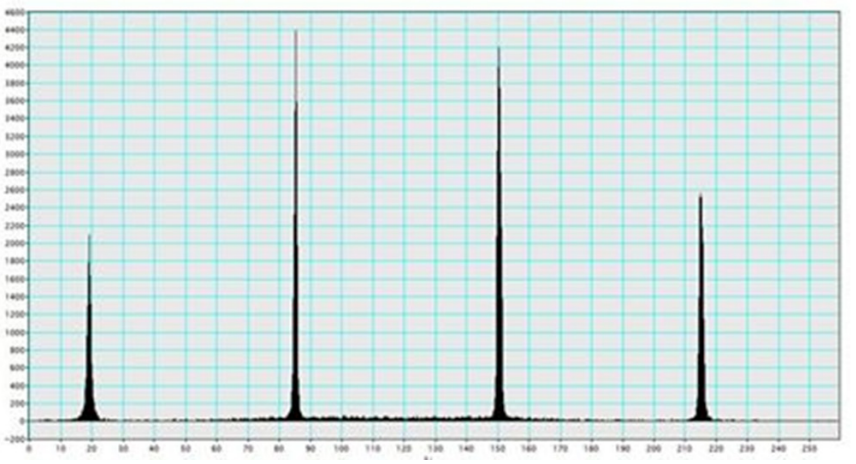
PRODUCT DATA	
GROWTH METHOD	Metallurgical graphene growth on liquid metal
STANDARD SUBSTRATES	PMMA, Si/SiO_2, , quartz
TRANSFER AVAILABILITY	Transfer on custom substrates available upon request
QUALITY CONTROL	Raman spectroscopy Optical microscopy SEM microscopy
FORM	Graphene film
GRAIN SIZE	Up to 1mm
COVERAGE*	>95%
OPTICAL TRANSMITTANCE*	>97% *(measured on quartz with UV-Vis method)*
THICKNESS (THEORETICAL)	0.345 nm
AVERAGE SHEET RESISTANCE*	<250 Ω/cm² *(measured on Si/SiO_2 with van der Pauw method)*
*values confirmed by EIT+ Wroclaw Research Centre independent product evaluation study	

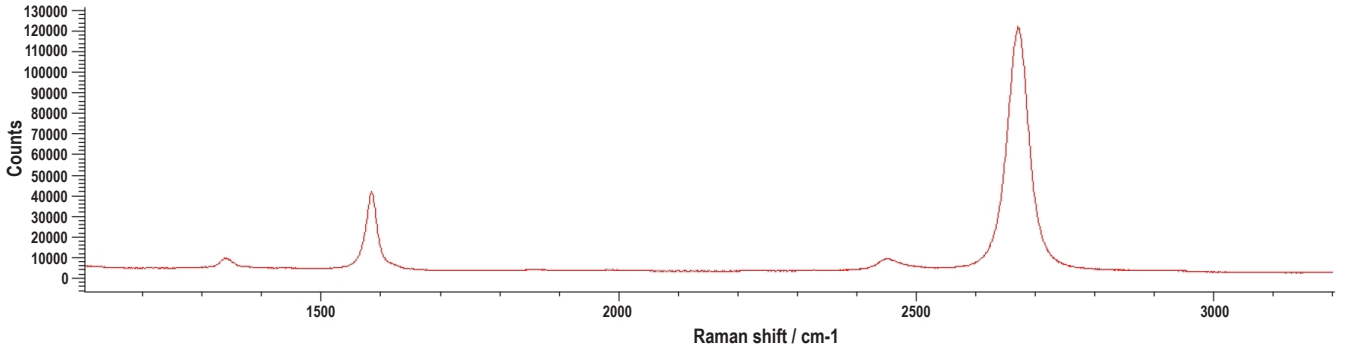
TEM*





HSMG® suspended on TEM grids

Raman spectroscopy



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