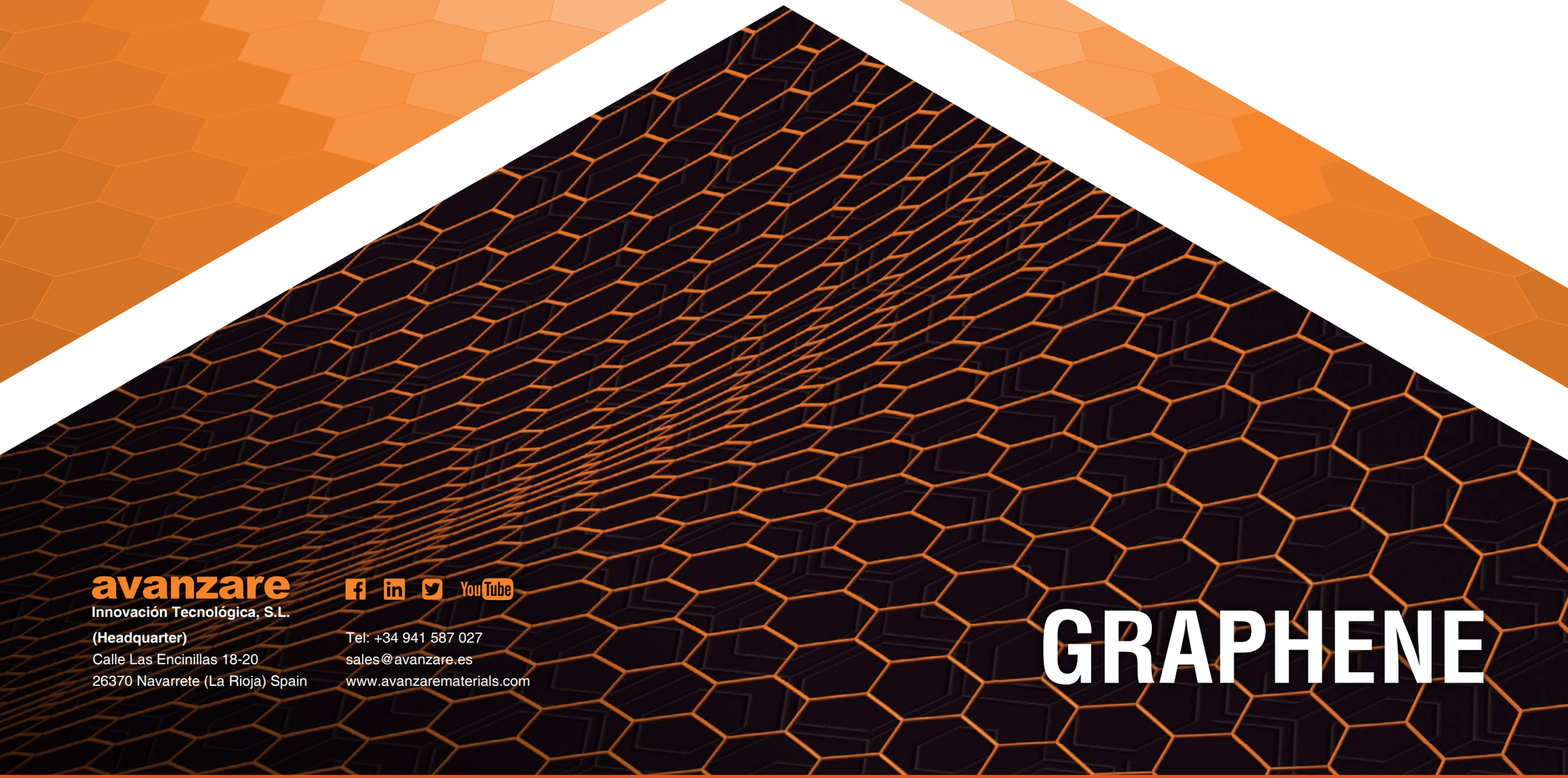
avanzare

inventing the future



GRAPHENE

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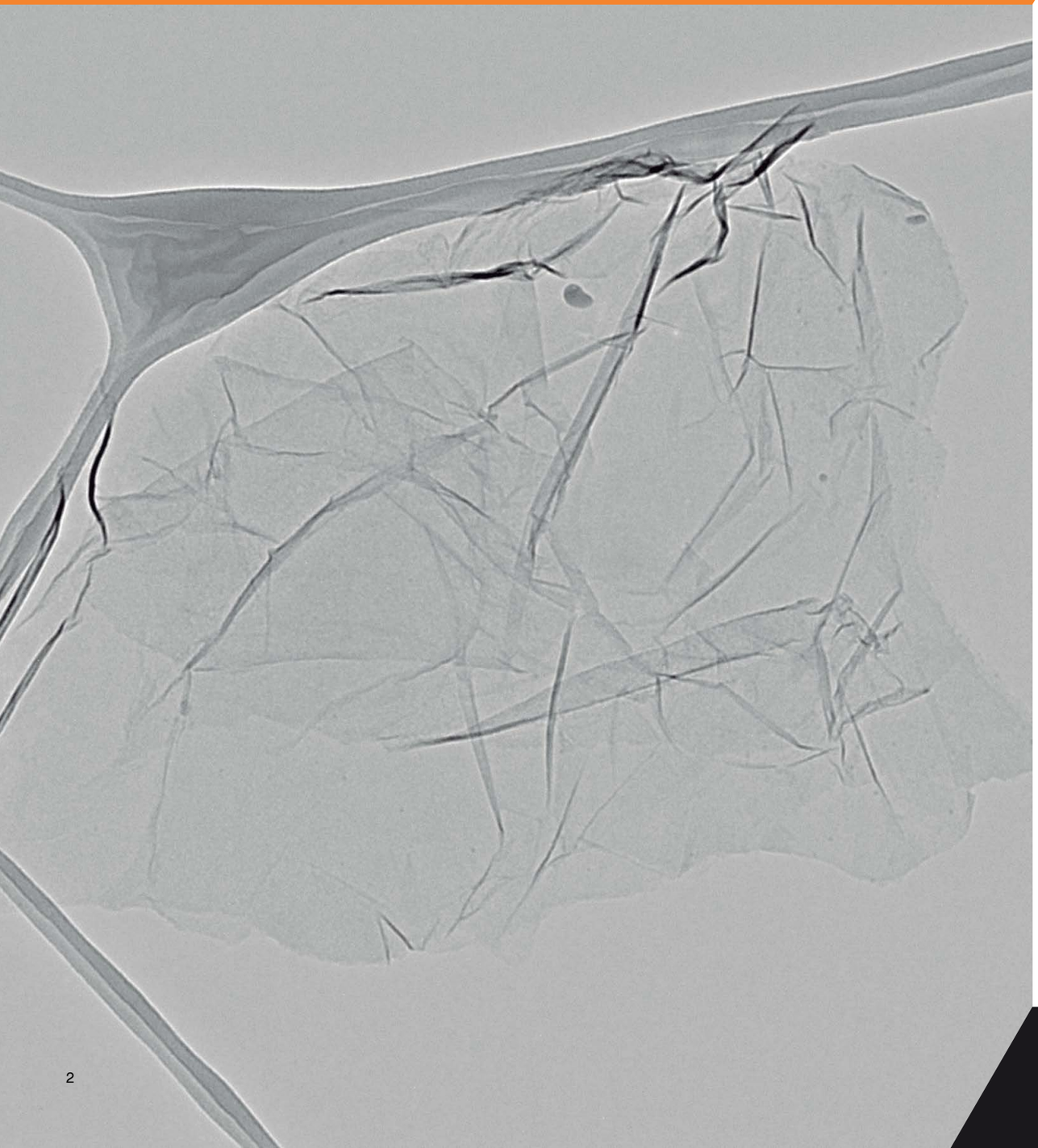


Shortly after the isolation of graphene **avanzare** has started producing graphene in multiple grades, for various industries, and a wide range of applications. Thanks to our lead time in the sector we have built a team of experts that is specialized mainly in industrial production and to some extent in R&D purposes. Our graphene additives are known by their enormous properties of high electrical conductivity, high thermal conductivity, and good integration in any matrix.

Our graphene materials are divided into industrial grade and research grades:

Industrial Degrees:

Main applications:

- **Generic multipropouse grade. avanGRP 40**
- **Improves thermal conductivity. avanTHERMAL Conductive**
- **Improves electrical conductivity. avanGRP Conductive**
- **Fire retardant additive. avanFIRE GR-8**

Degrees for research and development

- **Pristine Graphene**
- **Highly reduced Graphene oxide**
- **Patially reduced Graphene oxide**
- **Graphene Oxide**
- **Graphene / Graphite nanoplatelets.**

Industrial grades

Generic multipropouse grade. avanGRP 40

avanGRP 40 is specially developed for its integration in resins, plastics and rubbers, capable of providing the composite generated with an excellent thermal and electrical transmission.

This graphene NANOPLATELETS is intended to be an easy product to test and introduce into different matrices, which will serve as an introduction to the use of graphene for industrial agents.

The material is supplied in the form of black dry powder. Due to its size, thickness and characteristics, it can be integrated into any matrix, improving the electrical and thermal conductivity of the materials.

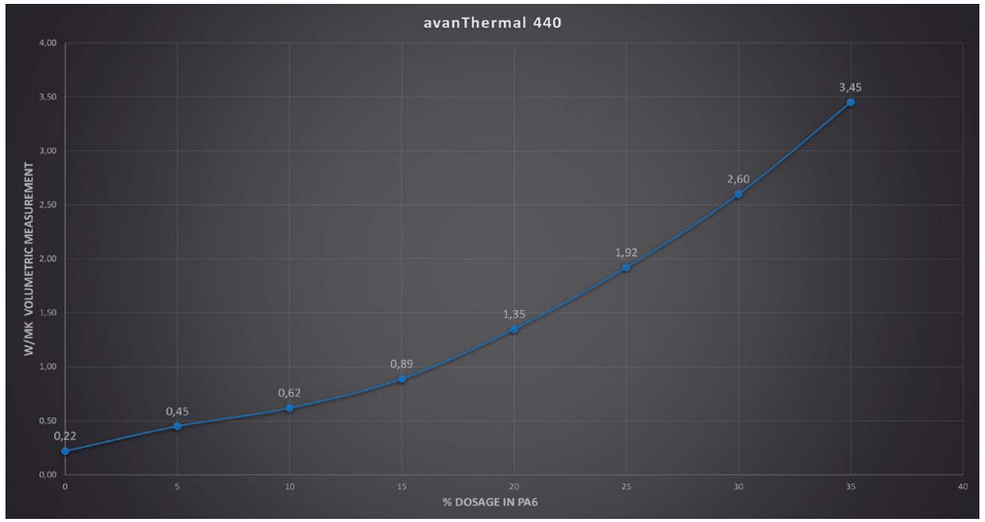
This graphene grade is especially for preliminary purposes.

The product is presented as MB upon customer request.

Improves thermal conductivity

avanTHERMAL CONDUCTIVE 440 is a graphene additive specifically designed to provide thermal conductivity to all types of materials and coatings.
Its dimension and special characteristic generate an easy material to be integrated in a wide range of matrices.

The generated composite is able to improve the **thermal transmission 10-20 times** more than the raw material.



Thermal transmission of different Composites with **avanTHERMAL CONDUCTIVE 440**

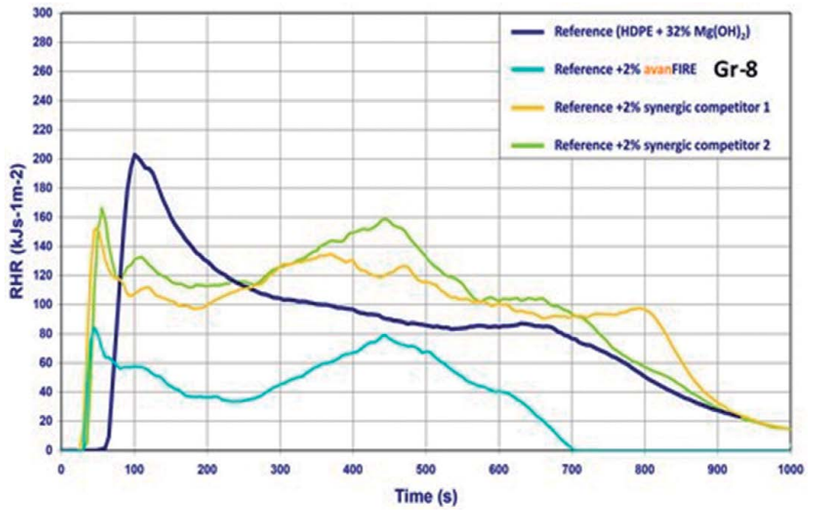
Tailor-made solution are available

For more info contact sales@avanzare.es or visit www.avanzarematerials.com

BLANK TREATED T=0 T=1H INTENSIVE USE

Flame retardant additive

avanFIRE GR-8 is a combination of graphene-derived materials which shows exceptional synergies with other FR additives containing polyphosphates and hydroxides.



avanFIRE GR-8 enhances compound's fire resistance performance thanks to the production of a carbonaceous layer (CHAR), which is very effective in preventing further contribution of combustibles and comburents to the flame, reducing dripping and distributing the energy produced by the flame (heat).

Improves electrical conductivity

avanGRP CONDUCTIVE. The use of graphene in the manufacture of composites with high electrical conductivity is one of the most developed fields of application so far.

avanzare has developed a family of graphene products specially modified and adjusted for each final product.

Main advantages of the use of graphene materials compared to other carbonaceous materials.

- **Low application dose.**
- **Less impact on fluency**
- **Easy integration**

	Raw material	Format	Dosage	Resistivity	Impact price
avanGRP CONDUCTIVE	General pro-pose	Solid	6-15	< 0.1 mohm	$ $
avanPLAT-2	Filament in PA6	Solid	3%	< 0.1 mohm	$
ACPS high Solid	Resins (EVER, UPR)	Wetted Powder	2-6%	KOHMS	$ $
avanGRP MB-505	General pro-pose	MB in EVA	10-40%	KOHMS	$
avanCON-DUCTIVE 334	Solvent base resins	Wetted Powder	2-6%	KOHMS	$
avanCON-DUCTIVE 212	Water base resins	Wetted Powder	2-6%	KOHMS	$

The dosage necessary to obtain a good conductivity is defined by the dispersion method and the polymer used. This can completely vary the final properties obtained.

The introduction of more% will produce an increase in the conductivity of the final material.

Tailor-made solution are available

For more info contact sales@avanzare.es or visit www.avanzarematerials.com

Image of an ATEX tank formulated with polyester resin and ACPS high Solid, and filament of conducting PET with **avanPLAT 2**

Degrees for research and development

All of our research grade are classified in function of:

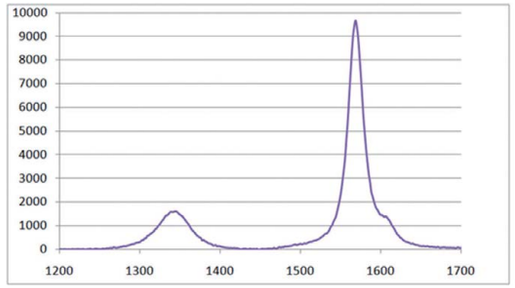
- Lateral size (XY structure)
- Average thickness
- Oxygen content

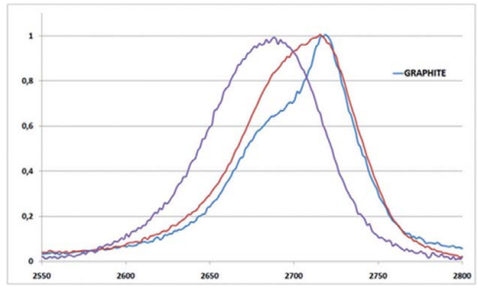
This the numbers that appear in these names represent the.. av –(A)-(B)-(C)

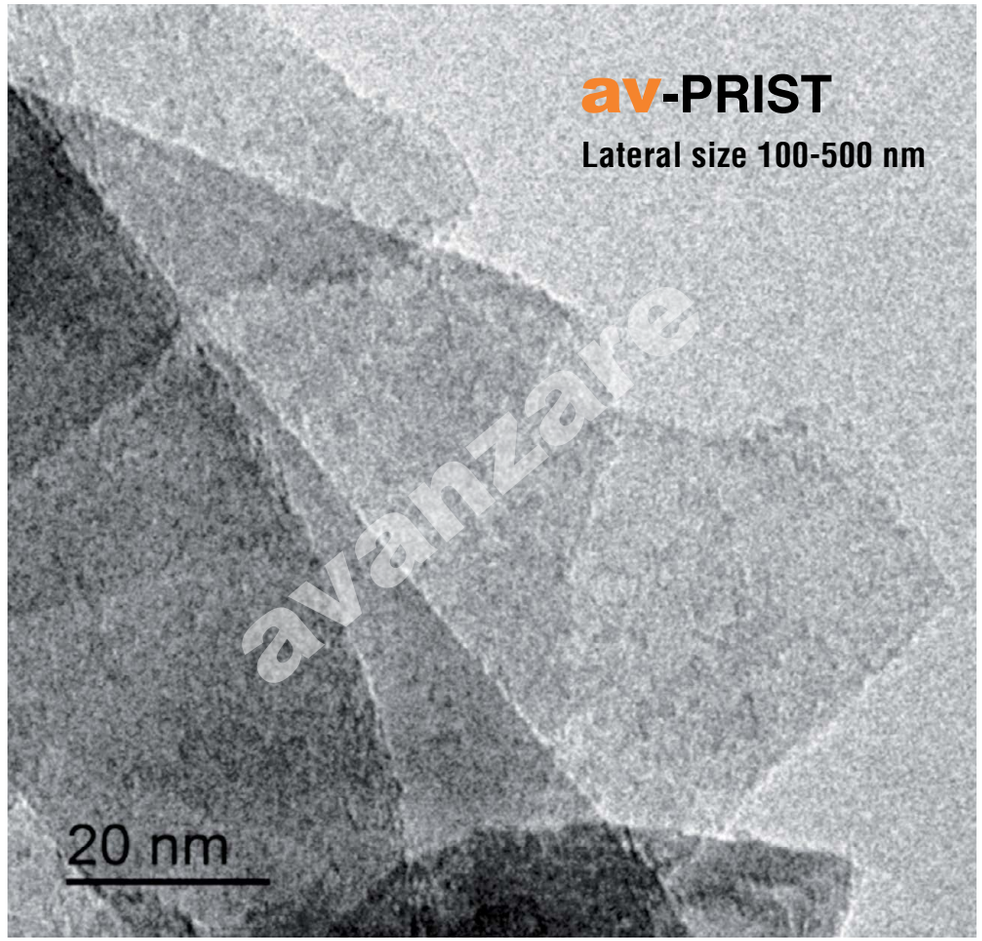
A) Lateral size (LD50)
B) Average thickness (nm)
C) % of oxygen

- Pristine graphene
  - **av**-PRIST
- Highly reduced graphene oxide:
  - **av**-70-1-1.5
  - **av**-40-1-1.5
  - **av**-70-3-3.5
  - **av**-40-3-3.5
- Partially reduced graphene oxide
  - **av**-70-3-8
  - **av**-40-3-8
  - **av**-70-3-20
  - **av**-40-3-20
- Graphene oxide
  - **av**-GOX-70
  - **av**-GOX-40
- Graphene/Graphite nanoplatelets
  - **av**-PLAT-2
  - **av**-PLAT-7
  - **av**-PLAT-40
  - **av**-PLAT-70

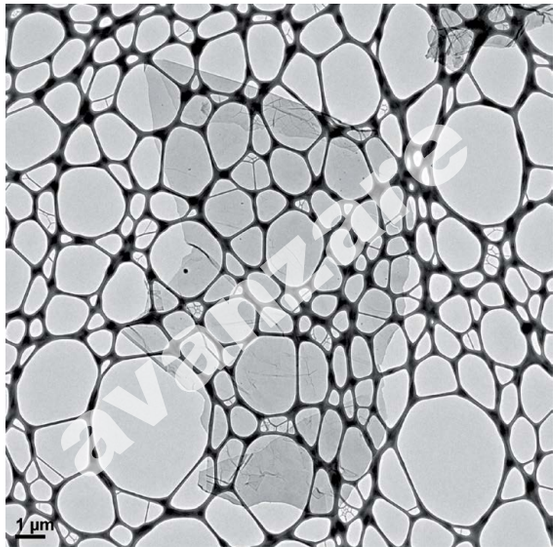
Pristine graphene







Highly reduced graphene oxide



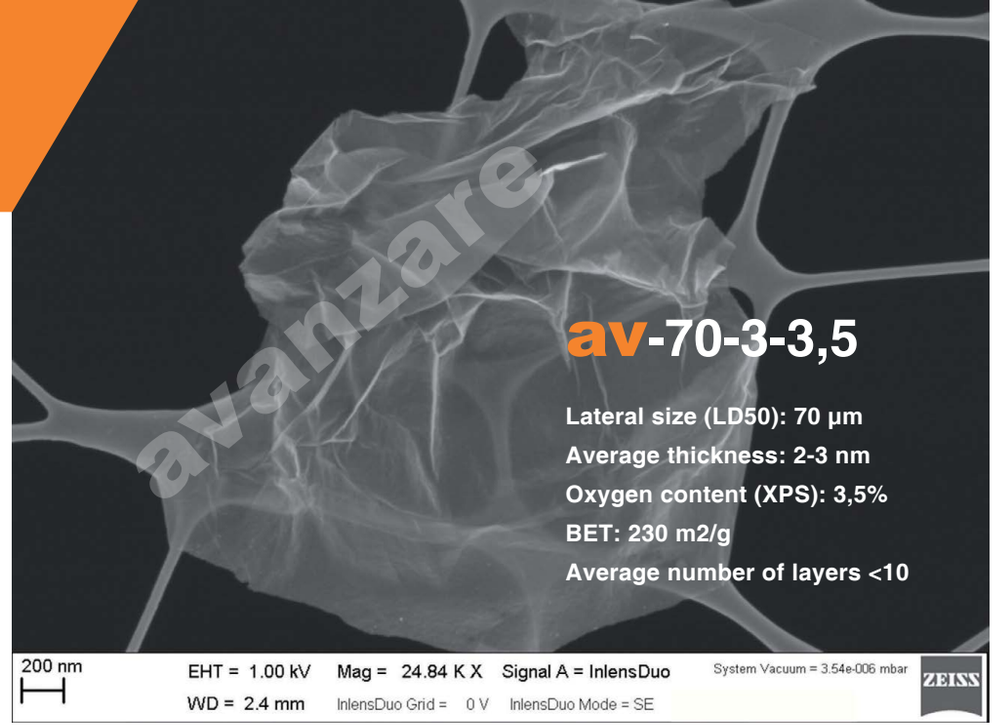
av-70-1-2,5

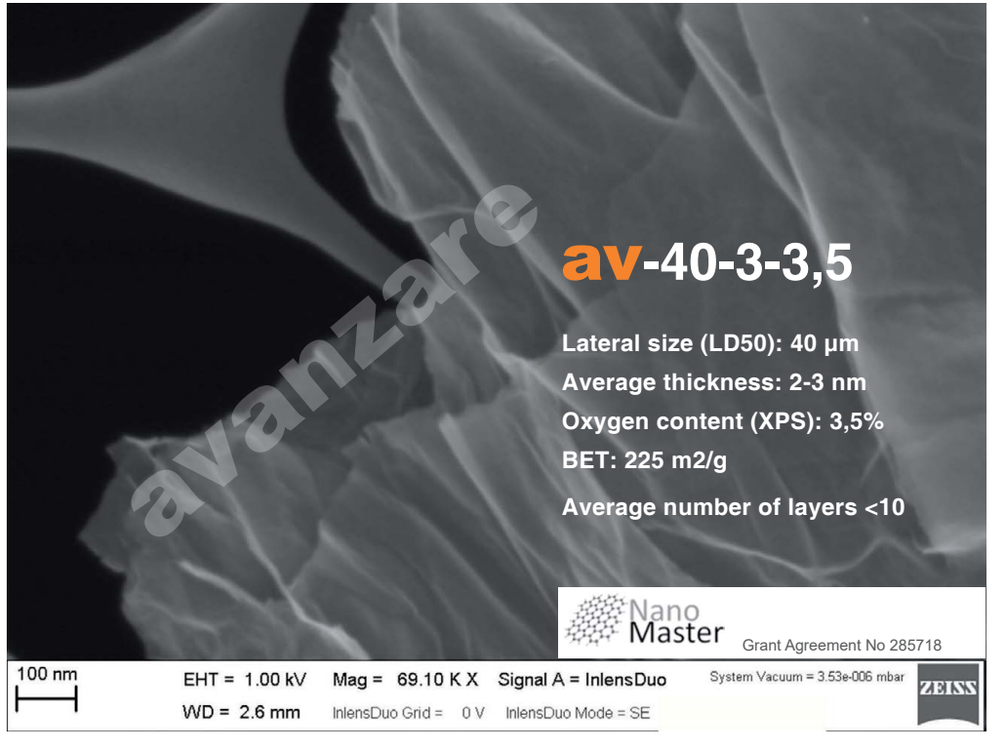
Lateral size (LD50): 70 µm
Average thickness: <1nm
Oxygen content (XPS): 2,5%
BET: 416 m2/g
Average number of layers <3

av-40-1-2,5

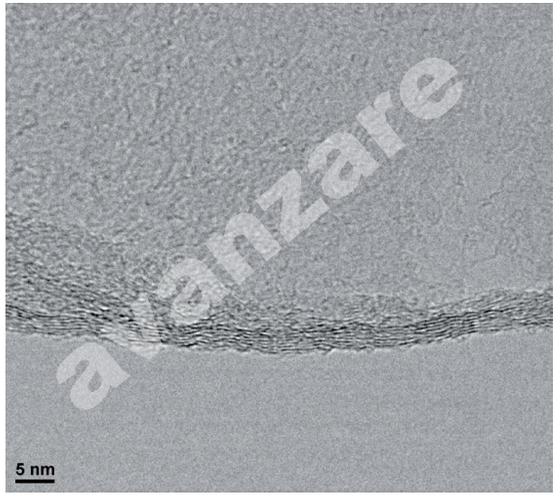
Lateral size (LD50): 40 µm
Average thickness: <1nm
Oxygen content (XPS): 2,5%
BET: 480 m2/g
Average number of layers <3

Nano Master
Grant Agreement No 285718



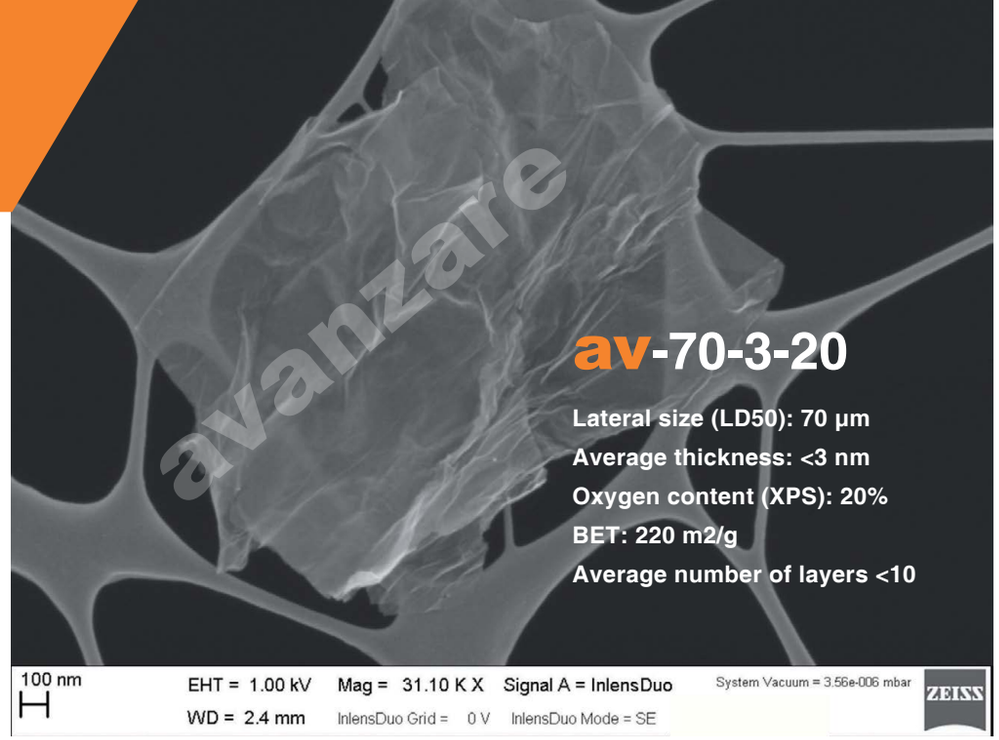


Partially reduced graphene oxide



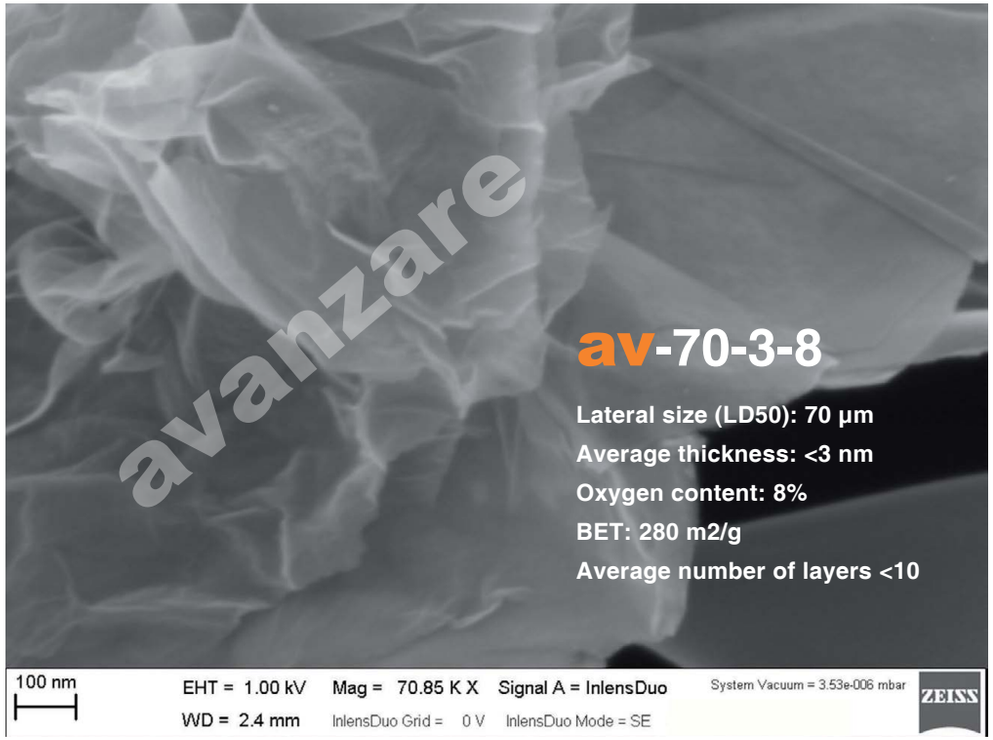
av-40-3-8

Lateral size (LD50): 40 µm
Average thickness: <3 nm
Oxygen content (XPS): 8%
BET: 260 m2/g
Average number of layers <10



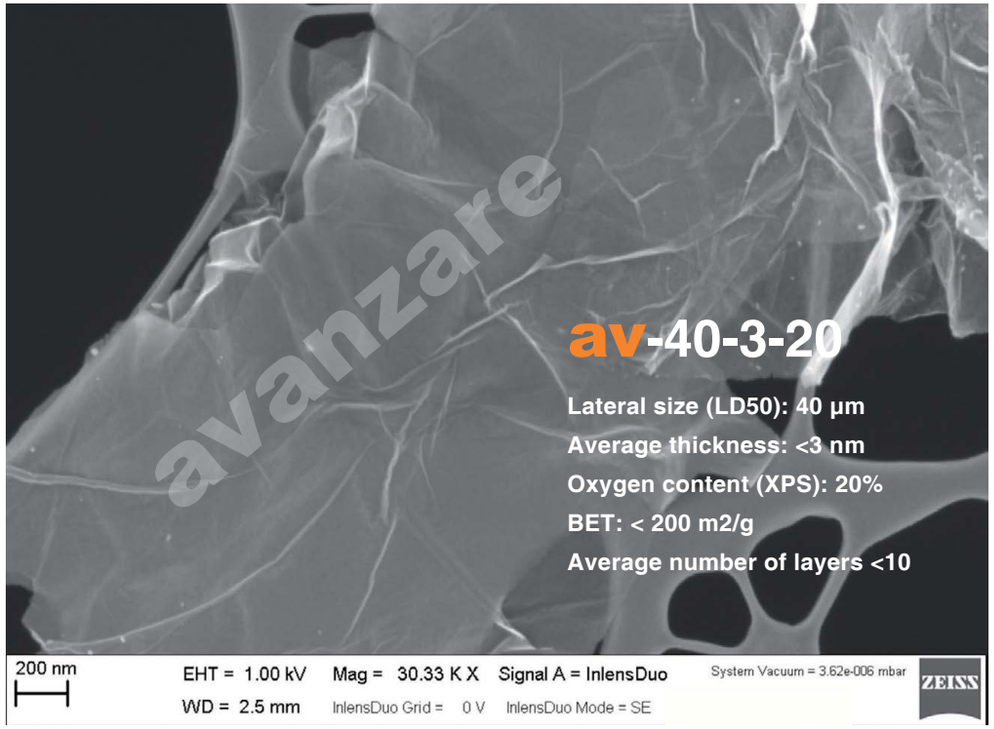
av-70-3-20

Lateral size (LD50): 70 µm
Average thickness: <3 nm
Oxygen content (XPS): 20%
BET: 220 m2/g
Average number of layers <10



av-70-3-8

Lateral size (LD50): 70 µm
Average thickness: <3 nm
Oxygen content: 8%
BET: 280 m2/g
Average number of layers <10



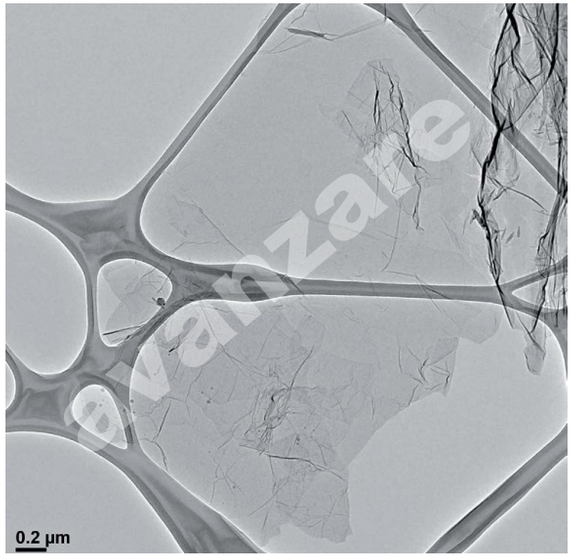
av-40-3-20

Lateral size (LD50): 40 µm
Average thickness: <3 nm
Oxygen content (XPS): 20%
BET: < 200 m2/g
Average number of layers <10

Graphene oxide

av-GOX-70

Lateral size (LD50): 70 µm
Average thickness: 1-2 nm
Oxygen content (XPS): 30%
BET: approx. 400 m2/g
Average number of layers 1-2



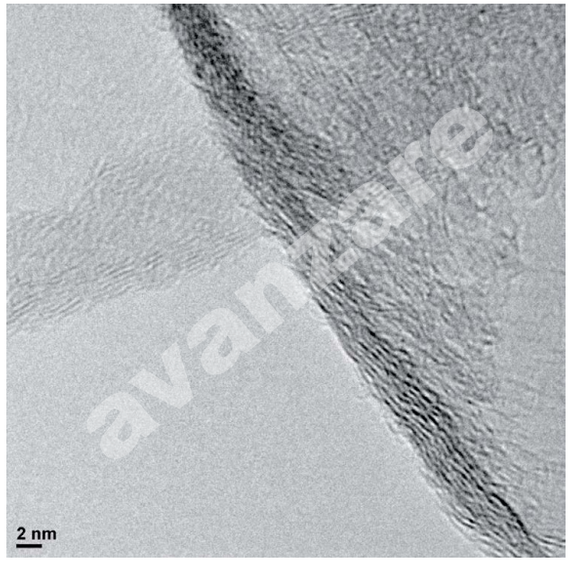
av-GOX-40

Lateral size (LD50): 40 µm
Average thickness: 1-2 nm
Oxygen content (XPS): 30%
BET: approx. 400 m2/g
Average number of layers 1-2

Graphene/graphite nanoplatelets

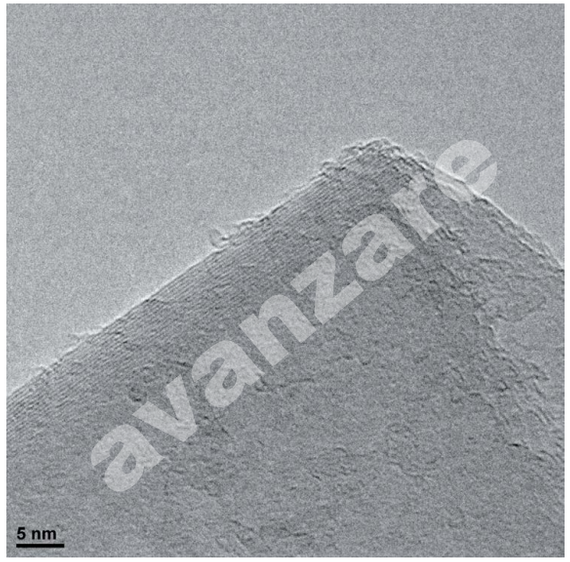
av-PLAT-2

Lateral size (LD50): 2 µm
Average thickness: <10 nm
Oxygen content (XPS): <1%
BET: > 200 m2/g
Average number of layers:
multilayer (<20)

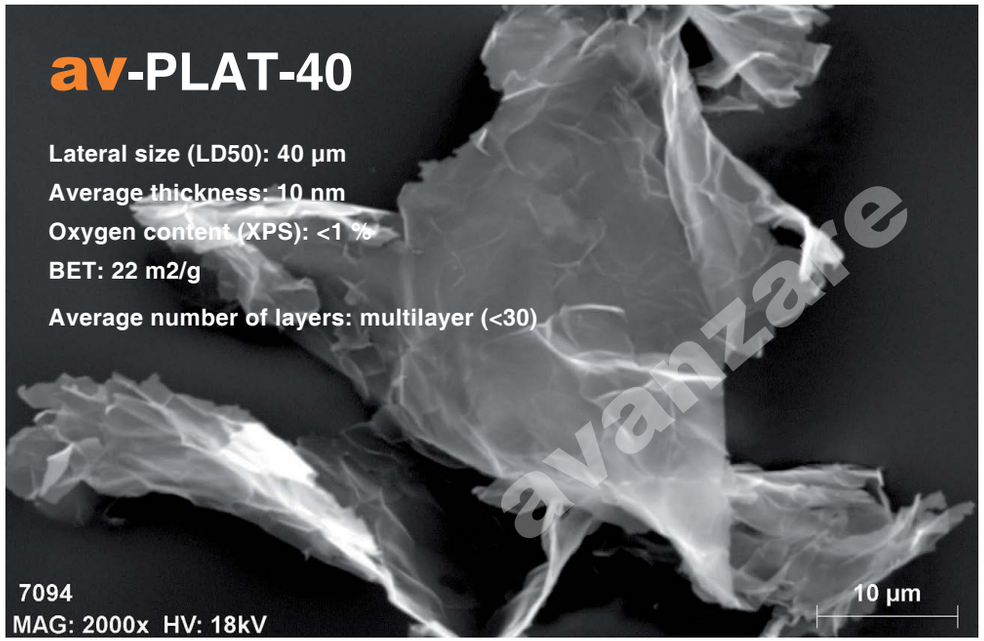


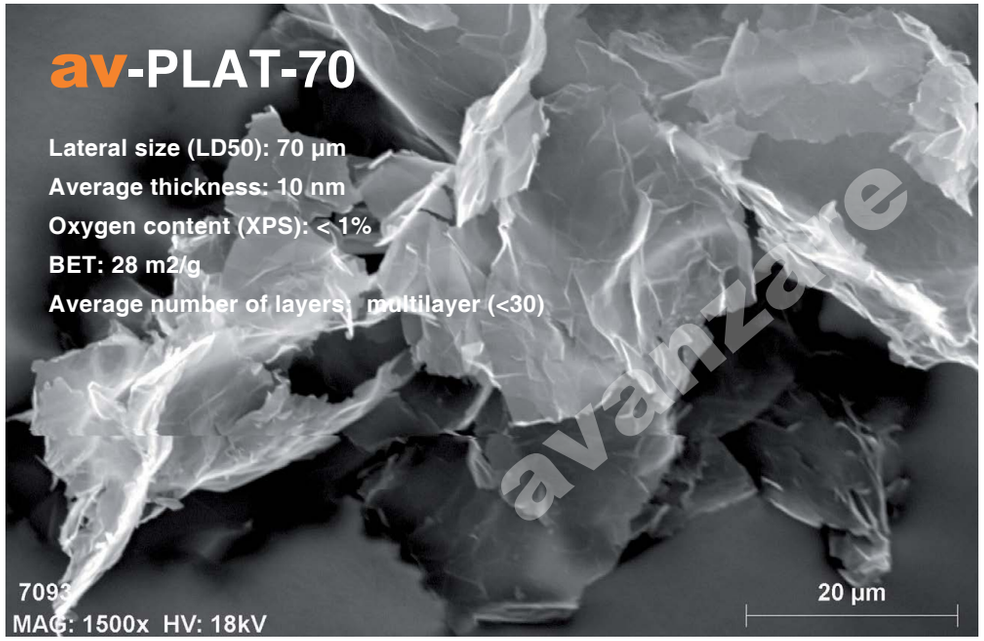
av-PLAT-7

Lateral size (LD50): 7.2 µm
Average thickness: 3 nm
Oxygen content (XPS): <1%
BET: 70 m2/g
Average number of layers:
multilayer (5-10)



Graphene/graphite nanoplatelets





Graphene-related projects

avanzare
inventing the future

As part of **avanzare**'s continuous search for improving and broadening its product range, it allocates many of its resources in Research and Development projects.

European Commission | Horizon 2020 European Union funding for Research & Innovation

Graphene Core1 & Graphene Core2 is supported by European Community's Horizon 2020 Framework Programme (H2020-Adhoc-2014-20) under Grant Agreement n° 696656 and under Grant Agreement nº 785219. These projects are the second and third in the series of EC-financed parts of the Graphene Flagship. They are funded by Programme for Research and Technological Development.
01/04/2016- 31/03/2020

European Commission | Horizon 2020 European Union funding for Research & Innovation

m3DLoC

M3DLoC aims at the employment of multi-material 3D printing technologies for the large-scale fabrication of microfluidic MEMS for lab-on-a-chip and sensing applications.. 01/01/2018 – 31/12/2021, http://www.m3dloc.eu ; Supported by European Community's Horizon 2020 Framework Programme Grant Agreement no. 760662

The Eurostars Programme is powered by EUREKA and the European Community

eurostars™

G-COOL: New coolants for high-performance engines. The consortium wants to improve the heat exchange capacity in cooling systems for combustion engines by using
nanofluids. 01/11/2018- 31/10/2020; It is funded by EUROSTARS E! 12375-G-COOL