AdvancedGraphenProducts

There is only one true graphene

The company, products and R&D projects.

ABOUT

Advanced Graphene Products is a nanotechnological venture focused on large-scale production and supply of graphene materials and development of graphene applications. Founded in 2012, AGP has prepared a highly efficient graphene manufacturing process and established industrial recognition as a fully-fledged partner.

PRODUCTS

AGP offers a unique selection of graphene materials, including:

- large-scale HSMG® graphene sheets,
- high quality CVD graphene,
- graphene grown on SiC,
- various forms of graphene oxides and reduced graphene oxides.

All parameters of our graphene sheets (size, substrates, etc.) can be tailored to your individual needs. We also provide a wide offer related to the preparation of metal contacts on graphene samples for any electrical measurements.

SERVICES

We offer assistance in any queries regarding graphene materials. Our services include:

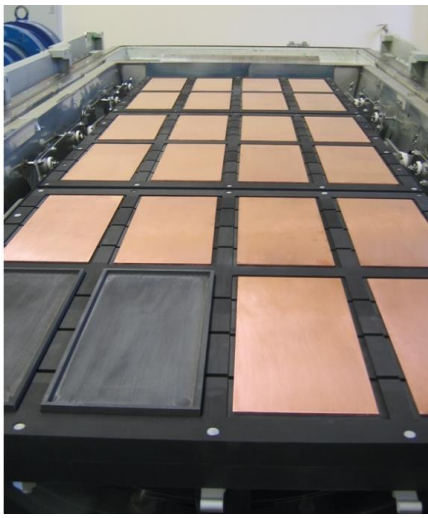
- Scientific assistance in graphene characterization, processing methods and data analysis;
- Availability of our specialized equipment (Raman spectroscopy, SEM, etc.) and conducting comissioned measurements;
- Partnership in research initiatives, especially those aimed at the development of graphene applications;
- Advanced as well as introductory training sessions on graphene processing methods (including theoretical background and practical courses)

Our Sales Support, together with our R&D Department, will readily answer all your questions about our products, collaboration options, available research equipment and scientific knowledge.

HSMG® High Strength Metallurgical Graphene

HSMG®

High Strength Metallurgical Graphene (HSMG®) is a large-area polycrystalline graphene sheet, characterized by unique stability and durability. Our patented manufacturing method is based on the graphene crystallization on the surface of liquid metal. Liquid matrix enables grain rotation and rearrangement during nucleation process which results in larger grain sizes and improved graphene properties. The method originated at the Institute of Materials Science and Engineering (Lodz University of Technology, Poland) and was developed in collaboration with AGP.



Remarkable properties of HSMG® include:

- Monocrystalline grain sizes up to 1mm
- Exceptional tensile strength and elongation
- Stable mechanical and physical properties under thermal fatigue conditions
- Very high graphene coverage (>95%)
- Easy transfer onto various substrates.

RESEARCH

AGP has strong research and development capabilities, including areas such as chemistry, physics and nanotechnology. Our finest achievement, among other things, is the development of HSMG® production method and receiving patents in EU, USA and Poland.

We constantly expand HSMG®'s transfer options and application potential.

The range of possible HSMG® applications is very broad and includes the following:

- Photovoltaic devices – improved efficiency;
- Laminates (composites) - ultra light and enhanced durability;
- Gas sensors – high responsiveness;
- Magnetic field sensors – improved reaction time and precision;
- Temperature sensors – working in extreme enviroments;
- Filtration membranes – high selectivity.

Additionally, HSMG® graphene can be used in the automotive industry (hydrogen storage), space industry, armaments industry, sports equipment, batteries, consumer electronics and many other industries. Advanced Graphene Products conducts extensive research on the above applications.

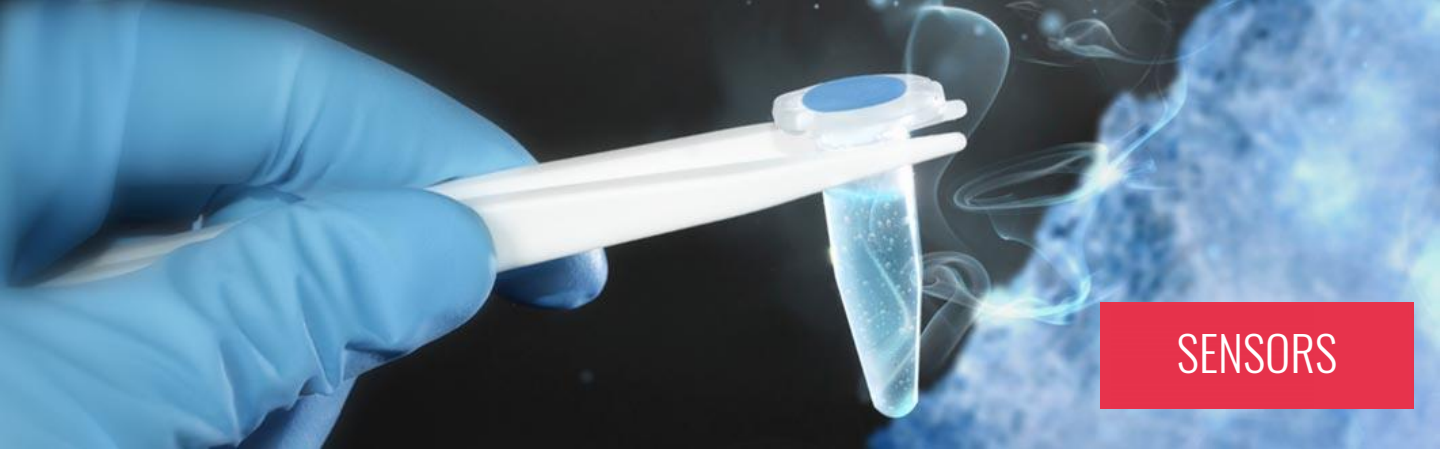
LAMINATES

The extraordinary mechanical properties of graphene, include tensile strength (~130 GPa) and the Young's modulus of 1 TPa, therefore HSMG® -based laminates hold great potential.

In addition to their outstanding strength, they offer excellent corrosion resistance. The use of this type of technology would allow to significantly reduce the weight of vehicles at a simultaneous increase of strength and durability.

This means a significant reduction in energy consumption. Future use of graphene composites can also be considered in the construction industry, particularly for high durability and weather resistance requirements.

Advanced Grapene Products is already cooperating with an industrial partner in terms of developing a HSMG®-enhanced laminate for highly durable sporting equipment.



SENSORS

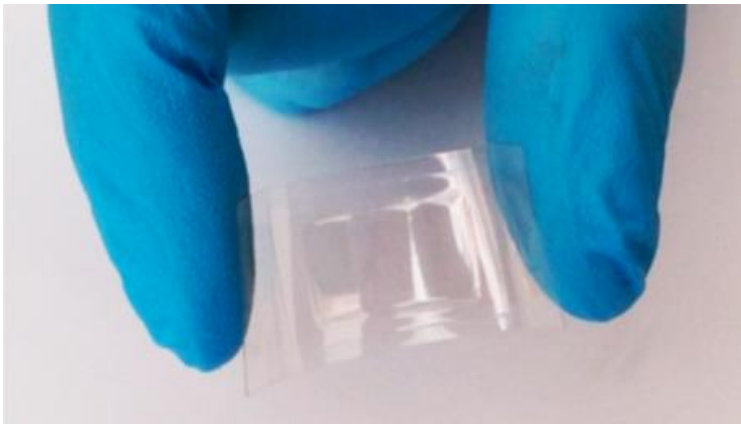
Constant, progressive miniaturization and increased complexity of electronic devices forces the development and implementation of new types of materials and technologies. Graphene as a material with a broad spectrum of applications could also be used as an active sensing layer. Today, HSMG® can be used for manufacturing:

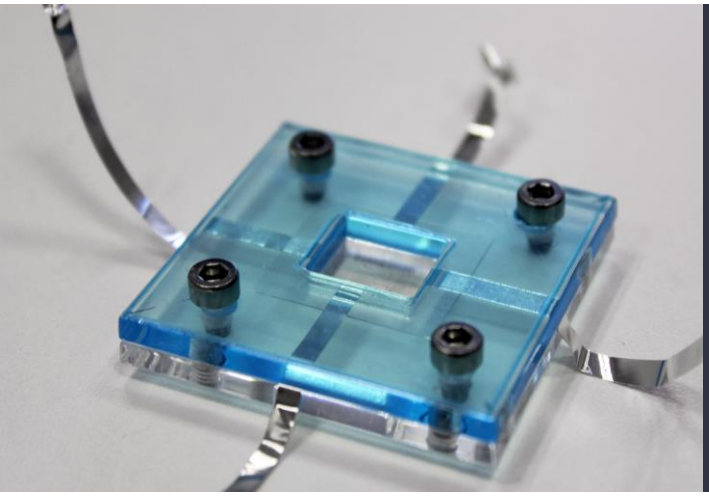
- Cryogenic temperature sensors;
- Hall-effect sensors for magnetic field measurements and positioning.
- Gas detection sensors;

Currently used cryogenic temperature sensors, although efficient and effective, have numerous disadvantages.

The most commonly used RTD sensors, made of pure metal, exhibit significant loss of sensitivity in temperatures below 50K. Regular negative temperaturę coefficient sensors (NTCs) do not have such limitations but their drawbacks include low accuracy and low time stability of parameters.

Using HSMG® as a cryogenic sensor material would eliminate the above-mentioned issues.





Hall sensors are used for magnetic field measurements, which is a paramount parameter in process engineering. Currently available Hall sensors are used only for high magnetic field measurements (above 1 mT) and exhibit numerous limitations.

Preliminary studies show that the use of HSMG® in the Hall sensor construction will allow precise measurements for medium and low magnetic fields (up to the range of nT), as well as eliminate the difficulty of conducting measurements in low and high temperatures.

HSMG®-based sensors could be used in new devices designed for industries such as biomedical engineering, navigation, and space engineering.

HSMG® can also be successfully used for manufacturing hydrogen sensors. Graphene, with its great sorption properties , perfectly fits into the role of an active material in such devices.

HSMG®-based prototypes feature a rapid responsiveness and exceptional stability. The sensitivity is also remarkable as they allow accurate detection up to individual molecules. They also feature extraordinary durability and resistance to corrosion, which can be of great importance for industrial applications.

FILTRATION

Another project is related to water treatment. Graphene is hydrophobic and naturally repels water, but with narrow pores, rapid water permeation is allowed. This sparked ideas regarding the use of graphene for water filtration and desalination.

Graphene sheets (perforated with miniature holes) are studied as a method of water filtration, because they are able to let water molecules pass but block out contaminants. Graphene's small weight and size can contribute to making a lightweight, energy-efficient and environmentally friendly generation of water filters and desalinators.

PHOTOVOLTAICS

HSMG® has excellent mechanical strength, but also very high thermal and electrical conductivity, transparency and extremely large surface area. HSMG® can revolutionize the photovoltaic industry by being used in energy conversion and storage.

Looking at the architecture of the photovoltaic cell, the HSMG® graphene can perform many roles, including layer, electrode or electron acceptor.

Our R&D department currently investigates the use of HSMG® for photovoltaic applications especially in relation to cell and panel construction.

A simple experiment, the coverage of polycrystalline silicon with a single layer of graphene, significantly increases the efficiency of a photovoltaic cell. The graphene layer acts not only as an electrode but also serves as an additional active layer. The HSMG® modified cell has increased it's efficiency in solar conversion by **more than 4x** in ccomparison to regular solar cell made with polycrystalline silicon.

The photo on the right presents two photovoltaic cells based on polycrystalline silicon. The outer layer of one of them was covered with HSMG® graphene. Increased efficiency is clearly visible.

COOPERATION

Advanced Graphene Products is a dynamic company, open for various types of cooperation.

We are able to form direct partnerships as a graphene supplier, since our production method is fully scalable and allows us to manufacture dozens of sq. meters of graphene within a month, which is sufficient for any industrial or commercial graphene application.

We will join your research projects, including both ongoing projects and new ones. We will collaborate with you by offering graphene related know-how, high quality equipment and the support of our highly qualified engineers.

AdvancedGrapheneProducts

Your graphene partner.

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