



# **EXPANDABLE GRAPHITE**

Halogen-free fire protection

## SUPPLIER. CONSULTANT. PARTNER.

### Quality and dependability since 1985

RMC Remacon is an independent private enterprise in South-West Germany. The company is domiciled in Bad Säckingen on the southern foot of the Black Forest, directly on the Swiss border. The enterprise was founded by Ludwig Förster in 1985 and has produced and marketed different technical carbons for technological and industrial applications since that time. The diversified customer portfolio includes groups operating world-wide, medium-sized as well as small companies and scientific institutions.

### The plus factor for our customers

RMC Remacon offers an enormous flexibility by decentralised structures and numerous production and warehouse sites in Germany, a widely diversified product range and material and technology know-how across industries.

Supporting customers in the further development of products and processes in an optimum fashion, RMC Remacon offers technical innovation consultation. Innovation projects are scientifically supported at RMC Remacon and provide a market edge that can be taken up to partentability.

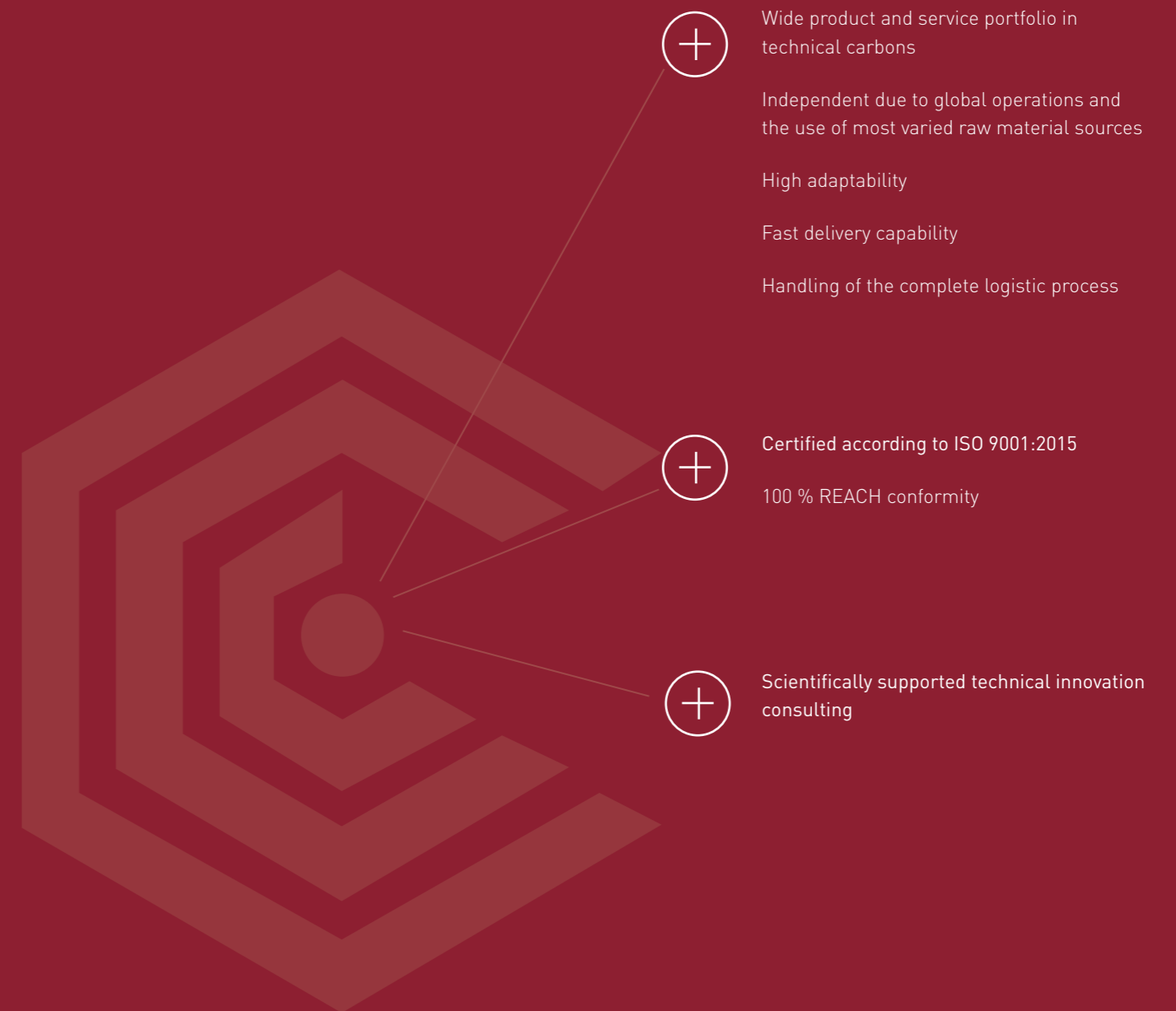
The unobjectionable quality of products and services is secured, among other measures, by qualified processes that are regularly audited by accredited bodies.

RMC Remacon works in according to REACH and ensures the conformity of materials used in close co-operation with domestic and foreign partners.



## PRODUCT AND PROCESS QUALITY

for more than 3 decades



# EXPANDABLE GRAPHITE

## DISCOVER THE VERSATILITY OF AN INNOVATIVE RAW MATERIAL

In a world where material innovation drives progress, Expandable Graphite stands as a remarkable example of the versatility and transformative power of materials science. This unique form of graphite, also known as Expandable Graphite, has attracted the attention of various industries and established itself as an indispensable component in numerous applications.

Expandable Graphite differs fundamentally from conventional graphite due to its remarkable ability to expand greatly when heated.

This expansion occurs due to the structure of the graphite, which consists of layers separated by gaps. When these gaps are activated by heat, the material expands rapidly, giving it a porous, lightweight structure. This property makes the material ideal for use in various fire protection applications.

The production of Expandable Graphite is a fascinating process that requires careful control and expertise. Based on our many years of experience and a worldwide network, we can offer Expandable Graphites whose properties have been specifically tailored to the requirements of our customers.

The areas of application for Expandable Graphite are as diverse as they are impressive. The material is ideal for use in building fire protection.

Expandable Graphite is used, for example, in the sealing of pipes and cables, between fire walls and ventilation systems. Seals containing Expandable Graphite protect doors and windows in the event of a fire. In varnishes and paints, Expandable Graphite ensures fire protection for steel beams, for example. Expandable Graphite is also used as a fire protection additive in the textile industry. The backing of aircraft carpets or passenger trains contains Expandable Graphite, as do innovative fire protection jackets. In addition to its use in fire protection applications, the expanding properties are also used in other applications, for example in metallurgy - where Expandable Graphite is used in covering powders. By foaming the graphite, the heat/energy is retained for longer.

This brochure is an invitation to delve deeper into the world of Expandable Graphite. We will explore the different manufacturing processes, learn about the unique properties of this fascinating material and provide a comprehensive overview of its wide range of applications. Join us on this journey and discover how Expandable Graphite is redefining the boundaries of what is possible in numerous industries.

Contact us to define the right material for your application

## BENEFITS OF RMC



### Long-term partnerships

Through our long-standing partnerships, we benefit from continuous developments, familiar production processes and functioning logistics.



### Technical Consulting

Our many years of experience in the field of technical carbons enables us to provide individual, technical advice based on your application.



### Quality control within Germany

The Expandable Graphites offered are tested and released in the German laboratory on a batch-by-batch basis. New developments are also tested and supply sources validated on this basis.



### REACH compliant, ISO 9001:2015, Ecovadis

We ensure REACH compliance for all materials, are ISO 9001:2015 certified and a member of Ecovadis.



### Rapid availability

By storing standard types in the German warehouse, rapid deliveries are possible. We usually supply our customers on the basis of framework contracts, which are then kept in the German warehouse for the long term. This enables flexible, rapid delivery without long delivery times and minimizes logistics risks in global transport.



### Further developments

We see ourselves as a supply partner who not only supplies existing raw materials, but also develops them further in collaboration with the customer if necessary. The implementation of new ideas and adjustments is what sets us apart.

# FROM NATURE

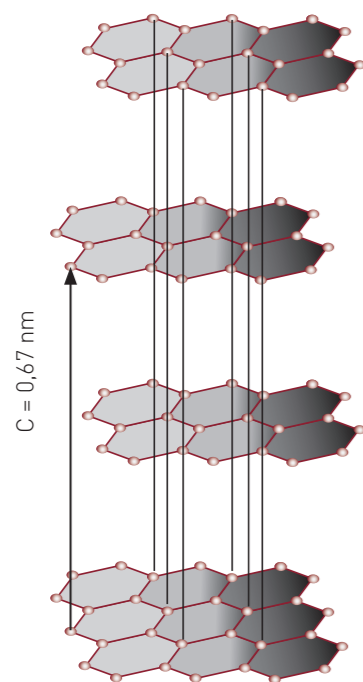
## GRAPHIT – THE NATURAL BASIS OF FLAME AND FIRE PROTECTION

Graphite is one of the most natural forms of carbon in its pure form, characterized by its hexagonal crystal lattice system. Gráphein means to write in ancient Greek; this is where the name graphite comes from, because graphite leaves its characteristic gray streak on paper or rough surfaces. It has been used in Europe for centuries and is characterized by its high temperature resistance. In an oxygen-free environment, graphite only sublimates at a temperature of well over 3,000°C. Graphite is resistant to non-oxidizing acids and is an excellent electrical and thermal conductor with anisotropic properties. The conductivity is

formed along the layers, but not across the layers. Due to the aforementioned hexagonal layer lattice structure and the weak Van der Waals forces between the individual layers, these can not only be easily moved against each other (lubricating properties), but also enable the introduction of bulking salts.

With the help of these acid compounds, which are stored between the layers, the material expands by several times its original volume when exposed to heat.

### LAYERED LATTICE STRUCTURE ENABLES UNIQUE PROPERTIES



Heat resistant up to > 3000° C  
(in =O2-free atmosphere)

Molecules can be embedded  
between the graphite layers.

These stored bulking salts/acid  
compounds expand when exposed  
to heat.

Enormous increase in volume –  
up to 500 times the original  
volume possible.

## FROM GRAPHITE ORE TO EXPANDABLE GRAPHITE



### Mining

The manufacturing process begins with the extraction of natural graphite ore, which is mined. These ores are extracted in the well-known graphite mining areas. These are usually located in Asia (China) or on the African continent.



### Grind

The mined ore is crushed and processed for further processing. This process serves as preparation for subsequent purification.



### Flotation

The crushed ore is cleaned by flotation (ore + water + flotation agent). Due to the hydrophobic properties of the graphite, the graphite can be easily separated from the other mineral components and thus floated to a purity of up to >95%. The graphite suspension is then dried for further processing.



### Sieving

The floated graphite is now sieved into different grain fractions. At this point, the raw material is classified for the different Expandable Graphite grades that will later be produced.



### Purification

Depending on the desired purity, the material is further processed using chemical purification so that the carbon content can be increased to up to >99%. For most of our Expandable Graphite types, this additional step is not necessary, as the carbon content of >95% is sufficient without chemical purification.

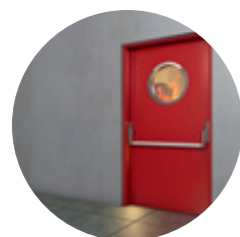


### Intercalation

The most important step in the production of Expandable Graphite is the so-called intercalation process. In various chemical process steps, expanding salts are incorporated into the graphite layer lattice structure (see diagram) with the help of acid compounds (e.g. H2SO4, HNO3) and oxidizing agents (e.g. KMnO4, H2O2). These compounds are firmly bound in the layer lattice structure of the graphite and ensure the desired expansion property when heat is applied. The types offered by RMC Remacon are processed **halogen- and chromium-free**.

# INDISPENSABLE

## IN MANY SECTORS INDUSTRIES AND APPLICATIONS



Building fire protection  
in doors and bulkheads



Expandable Graphite  
in bitumen roofing membranes



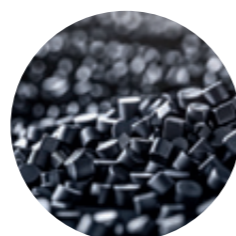
Fire Protection in Functional Textiles



Coating of seats / carpets



Seals in electric car batteries



Fire and Flame Protection  
in Plastic Components

## APPLICATION EXAMPLES

### Building fire protection

- Seals for various types of pipe and cable connections between fire walls and ventilation systems contain Expandable Graphite.
- Seals with Expandable Graphite protect doors and windows in the event of a fire.
- Thermal insulation with Expandable Graphite prevents the uncontrolled spread of fire on facades.

### Paints and varnishes

- Fire protection coatings with Expandable Graphite increase the stability of components in the event of fire (e.g. steel beams or components in transport traffic).

### Textile industry

- Seats and carpet backings in airplanes or trains contain Expandable Graphite for fire protection, as do protective equipment for firefighters.

### Plastics industry

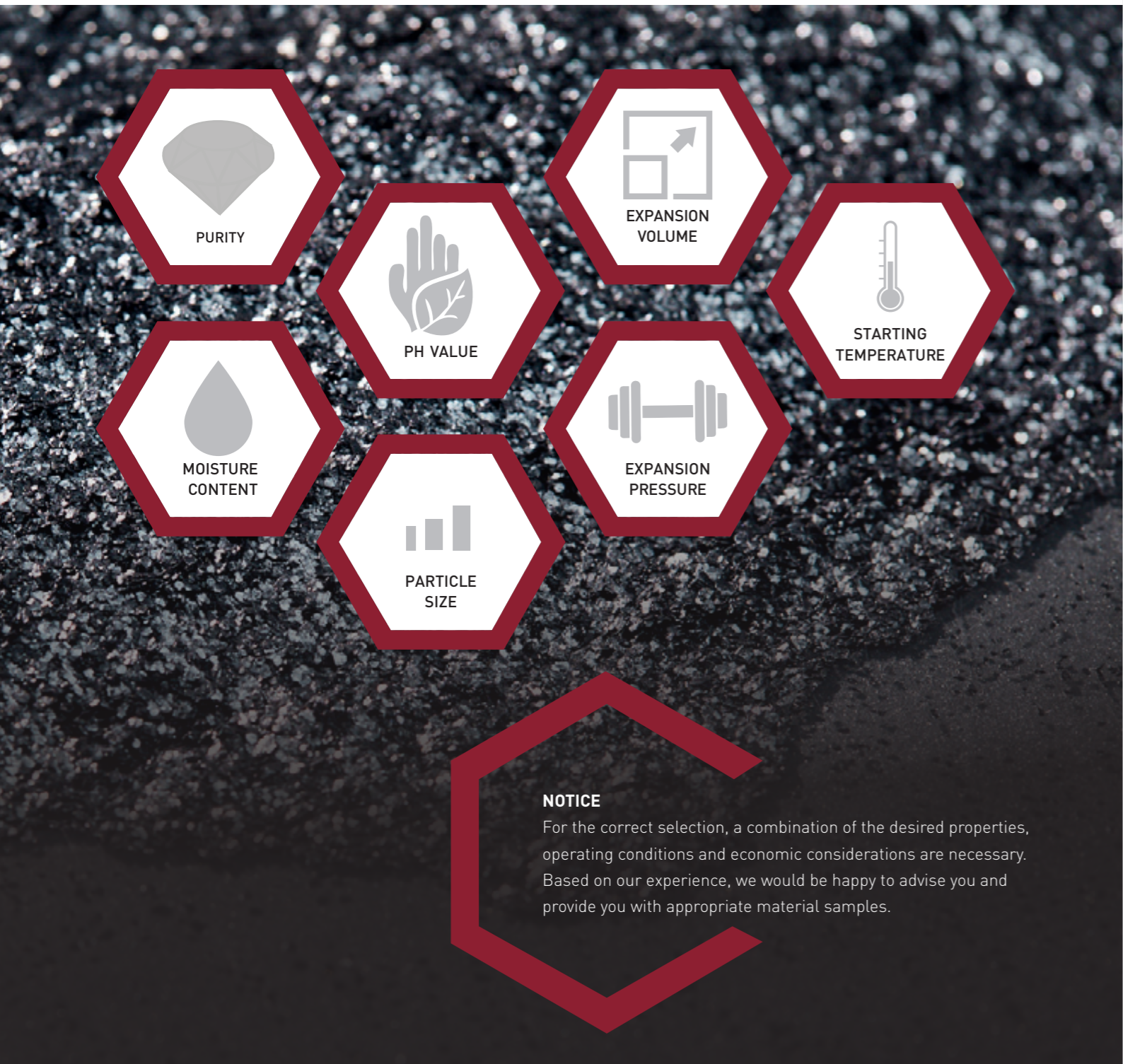
- Expandable Graphite is incorporated into a wide variety of plastics as a fire protection additive. End applications include polyurethanes, for example for mattresses and vehicle seats, as well as high-tech housings for vehicle batteries.

### Metallurgy

- Expandable Graphite has long been used for covering powders to keep the heat in the melts for longer.

# CHARACTERISTICS

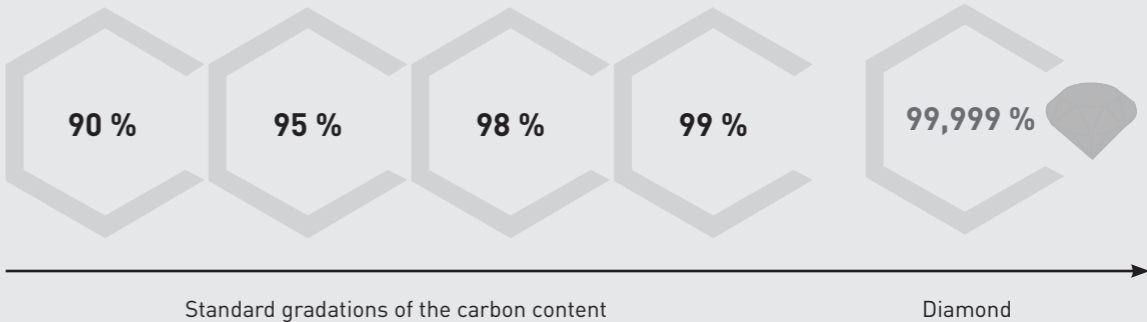
## THE PRODUCT PROPERTIES OF EXPANDABLE GRAPHITE



**NOTICE**  
For the correct selection, a combination of the desired properties, operating conditions and economic considerations are necessary. Based on our experience, we would be happy to advise you and provide you with appropriate material samples.



**Purity**  
The purity of the Expandable Graphite is classified by its carbon content. This is adjusted by means of flotation/chemical purification (see production). Our Expandable Graphites are generally available in purity levels of 90% - 99% carbon. Since the expansion properties depend largely on the choice of graphite flake (origin/ grain size) and the intercalation agents, the carbon content is usually not a major focus when selecting a type. Our Expandable Graphites have a standard purity of 95% - 98% carbon.



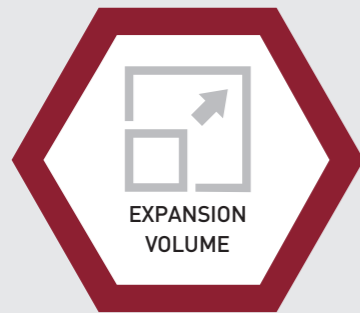
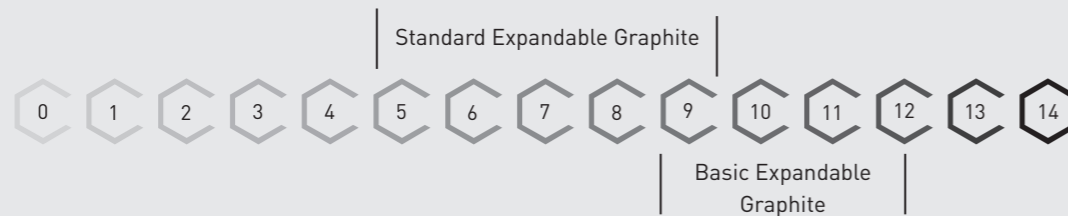
**Moisture content**  
The moisture content of Expandable Graphite is typically >1%. With special processing specifications, this can be reduced to < 0.5% to < 0.2%, depending on the type.





### PH value

Our standard types are generally specified with a neutral pH value (5-9). The pH value depends on the manufacturing process and the processing of the material. An acidic Expandable Graphite pH <4 can indicate poor cleaning of the graphite or dissolving of the expanding salts based on a damaged Expandable Graphite flake (high shear forces/fragmentation of the flake). This can lead to chemical reactions or even corrosion. Contact us if you need Expandable Graphite in a basic environment. For this we have a type with pH 9 - 11.



### Particle sizes, expansion pressure, expansion volume

The three parameters: grain size, expansion Volume and expansion pressure are parameters that are interdependent. Due to the layered lattice structure of the graphite, the larger the flake size, the better the expansion properties, as the number of layers then enables greater expansion.

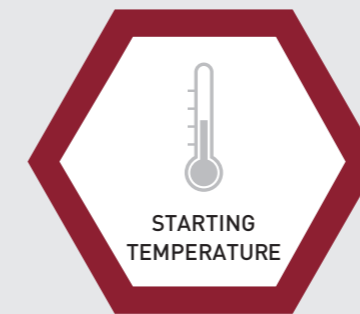
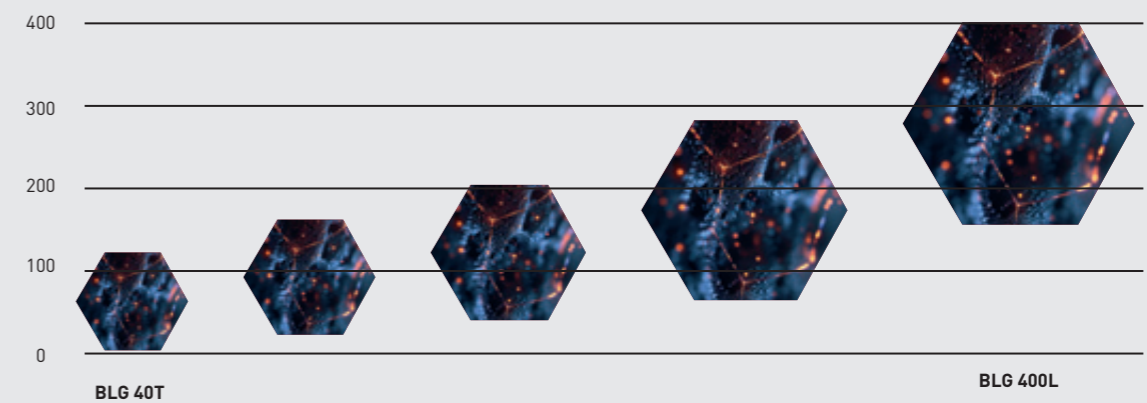
### Application or production process requires different grain sizes



The choice of grain size therefore has a significant influence on the material properties. Our standard types have a grain size of 80% >250 µm. The expansion rates here are around 250 - 300 times the original volume. With our coarsest types such as BLG 400L 80% > 500 µm we achieve expansion rates of > 450 ml/g.

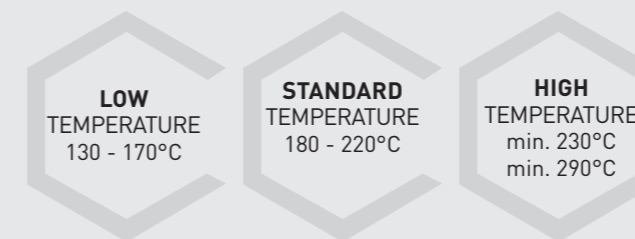
The Expandable Graphite with the smallest grain size (BLG40T) has a grain size of 80% < 75 µm. The expansion here is just 40 cm³/g. In addition to determining the volume increase, the types are also tested for the expansion pressure. These parameters also depend on the grain size and can be defined together.

### The expansion rate determines the flame retardant effect (cm³/g)



### Starting temperature

The starting temperature defines the temperature at which the process of graphite expansion or swelling begins. Here we measure the first significant movements in the material. From this temperature point onwards, the Expandable Graphite expands. It should be noted that this does not happen explosively from the start, but rather an increase in the temperature curve is necessary. Depending on the type, the full increase in volume is only reached at a temperature of 600°C - 1,000°C. The starting temperature is usually between 180°C - 200°C. We also offer types with lower starting temperatures (130°C - 170°C). In addition, high processing temperatures can mean that Expandable Graphite with a higher starting temperature is required, e.g. for polymers such as polyamide. For this purpose we offer Expandable Graphite with late starting temperatures of up to 290°C.



# TYPE OVERVIEW

## STANDARD PRODUCTS

Standard Expandable Graphite in different grain sizes

Type	Carbon content	Starting temperature	Expansion	Grain size distribution
BLG 250T	> 95 %	ca. 200°C	> 250 cm <sup>3</sup> /g	70 % > 300 µm
BLG 150L	> 95 %	ca. 180°C	> 100 cm <sup>3</sup> /g	80 % < 150 µm
BLG 90 L	> 90 %	ca. 180°C	> 200 cm <sup>3</sup> /g	80 % > 180 µm

Expandable Graphite with high expansion

Type	Carbon content	Starting temperature	Expansion	Grain size distribution
BLG 300L-HE	> 98 %	ca. 180°C	> 350 cm <sup>3</sup> /g	70 % > 300 µm
BLG 300 TS	> 95 %	ca. 180°C	> 400 cm <sup>3</sup> /g	80 % > 300 µm
BLG 400L	95 % o. 99 %	ca. 150 –180°C	> 400 cm <sup>3</sup> /g	80 % > 500 µm

Expandable Graphite with low starting temperature

Type	Carbon content	Starting temperature	Expansion	Grain size distribution
BLG 300L-LT	> 95 %	ca. 130 – 170°C	> 200 cm <sup>3</sup> /g	70 % > 300 µm

Expandable Graphite with high starting temperature

Type	Carbon content	Starting temperature	Expansion	Grain size distribution
BLG 300L-HT	> 95 %	ca. 230°C	> 200 cm <sup>3</sup> /g	70 % > 300 µm
BLG 300L-EXH	> 95 %	ca. 270°C	> 200 cm <sup>3</sup> /g	70 % > 300 µm
BLG 300L-EHT	> 92 %	ca. 290°C	> 200 cm <sup>3</sup> /g	70 % > 300 µm

Expandable Graphite with fine grain size

Type	Carbon content	Starting temperature	Expansion	Grain size distribution
BLG 40T	> 95 %	ca. 200°C	> 40 cm <sup>3</sup> /g	80 % < 75 µm
BLG 90T	> 90 %	ca. 180 – 200°C	> 90 cm <sup>3</sup> /g	60 % > 75 µm

In addition to the standard products listed, we stock a wide range of Expandable Graphite grades that have been precisely tailored to the customer's application. If you need an Expandable Graphite for your application that is not listed in the overview, please feel free to contact us. You can also get an insight into the current portfolio and new products on our website [www.rmc-remacon.com](http://www.rmc-remacon.com).



RMC Remacon GmbH  
Hugo-Herrmann-Straße 15  
D-79713 Bad Säckingen

fon +49 7761 939930  
[info@rmc-remacon.com](mailto:info@rmc-remacon.com)  
[www.rmc-remacon.com](http://www.rmc-remacon.com)