Krauss Maffei

Pioneering Plastics

FOAM EXTRUSION LINES

IZODER - Technical workshop (EPS extrusion processes)

Agenda

Foam extrusion line for EPS beads

Introduction KraussMaffei

EPS Beads – Requirements, properties and applications

KraussMaffei – Technical solution

Recycling and global market trends

Conclusion

Kraussmaffei Group

Facts

PIONEERING PLASTICS

SINCE 1838

Injection Molding Machinery

Extrusion Technology

Reaction Process Machinery

1,200 m€	~ 900	~ 4.700	~ 60
Group sales In 2022	Patents	Employees	Locations worldwide

KraussMaffei Pioneering Plastics

High problem-solving expertise for numerous industries

Technology expertise as a unique selling proposition

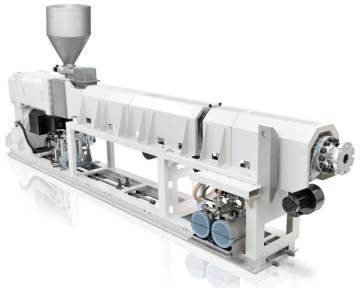
EXTRUSION TECHNOLOGY

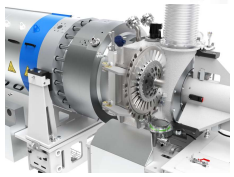
- Shaped Products
- Compounding
- Flat & Foam Products
- Tire & Rubber Products
- Melt to Pellet
- Circular Economy



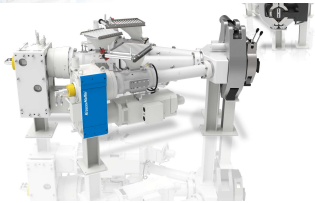










EPS BEADS

Requirements, properties and applications

EPS Beads

Overview

xEPS Beads

- Throughputs approx. 50 – 7500 kg/h
- Polymer: Standard Polystyrene
- Blowing agent: Pentane
- MB: Graphite, FR, Nucleating, Additves
- Shape: Micropellets, spherical
- Pellet diameter usually 0,9 – 1,3 mm
- Bulk density usually > 600 kg/m3

Why EPS?

- ☑ Lightweight (e.g. packaging)
- ☑ Insulation properties (e.g. thermal insulation)
- ☑ **Versatility** (various form such as blocks, sheets,…)
- ☑ Ease of processing
- ☑ **Cost efficiency** compared to many other materials
- ☑ **100% recycable**

Source (picture): https://www.synthosgroup.com

EPS Beads

Requirements

Bulk density (~0,6 kg/m³) → Different applications require different densities to ensure specific performance characteristics such as strength and insulation

Uniform Cell Structure → Important to achieve the desired mechanical and thermal properties.

Particle Size Distribution (0,9 to 1,3mm) → Critical factor for processability and the performance of the final product

Surface Quality → Especially in applications where a smooth surface is important, such as in molded parts or certain packaging applications

Physical Properties → compressive strength, elasticity, and thermal conductivity should meet the requirements of the specific application.

EPS Beads

Applications

Construction

Packaging

Automotive

Source: https://bewi.com/

TECHNICAL SOLUTION BY KRUSSMAFFEI

Physical foaming

KraussMaffei Pioneering Plastics

Steps of foaming process

- In the first section of the extruder, polymers are melted together with additional additives, utilizing both heat energy and shear energy.

→ Melting the polymer (GPPS) with further components such as flame retardants, graphite, nucleating agents etc.

- The shear elements in the second section of the extruder blend the blowing agent (pentane) in the polymer matrix.

→ Homogeneous distribution and optimum dissolution of blowing agent in the melt is required.

- In the final step, increasing the pressure and cooling of the melt is necessary to enhance stability upon exiting the extrusion section into the die.

→ An optimum process temperature is required to keep the blowing agent dissolved which results in the stability of the foam pores.

Technical solutions by KraussMaffei

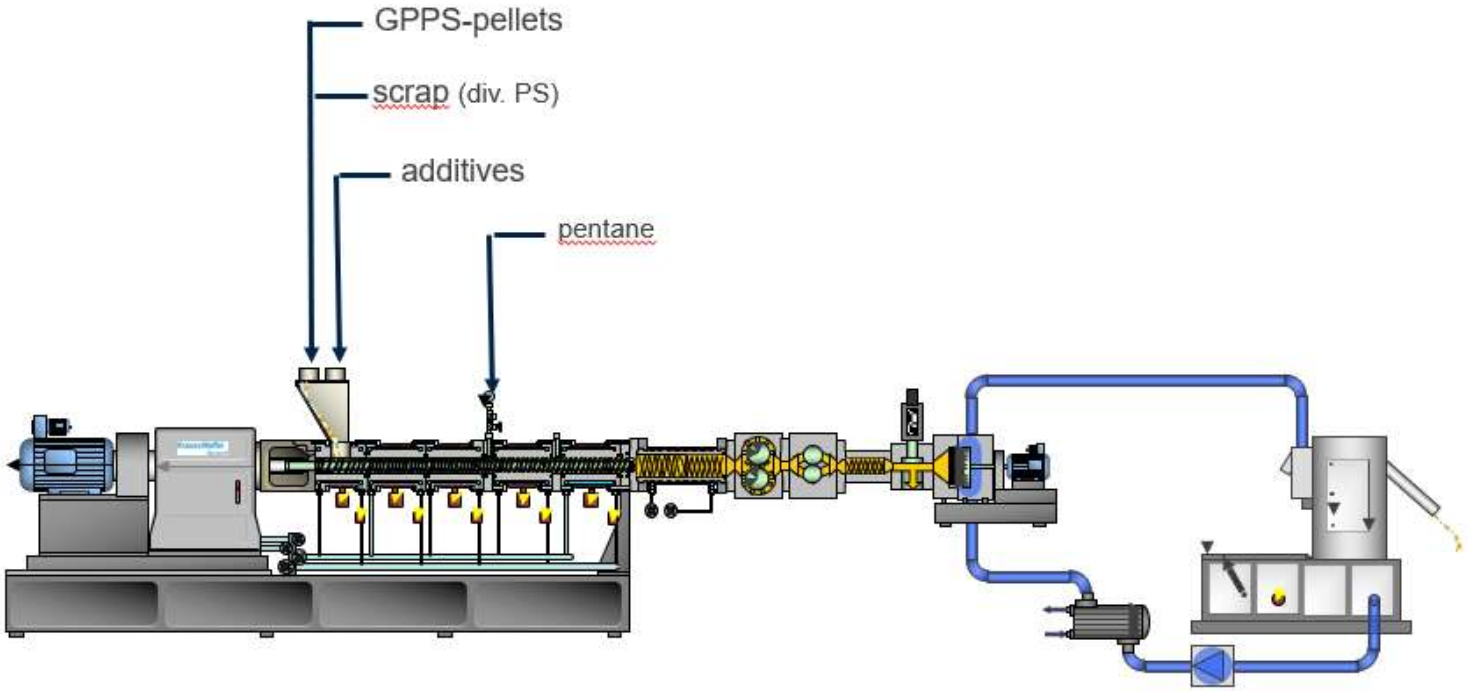
Schaumex = Twin screw extruder with melt cooler

- Schaumex is the technical solution with on extruder in the extrusion line
- Used for EPS foam extrusion lines with low throughputs
- A subsequent melt cooler replaces the second cooling extruder
- Advantage: Lower investment costs and space saving

* Depending on the product

Schaumex

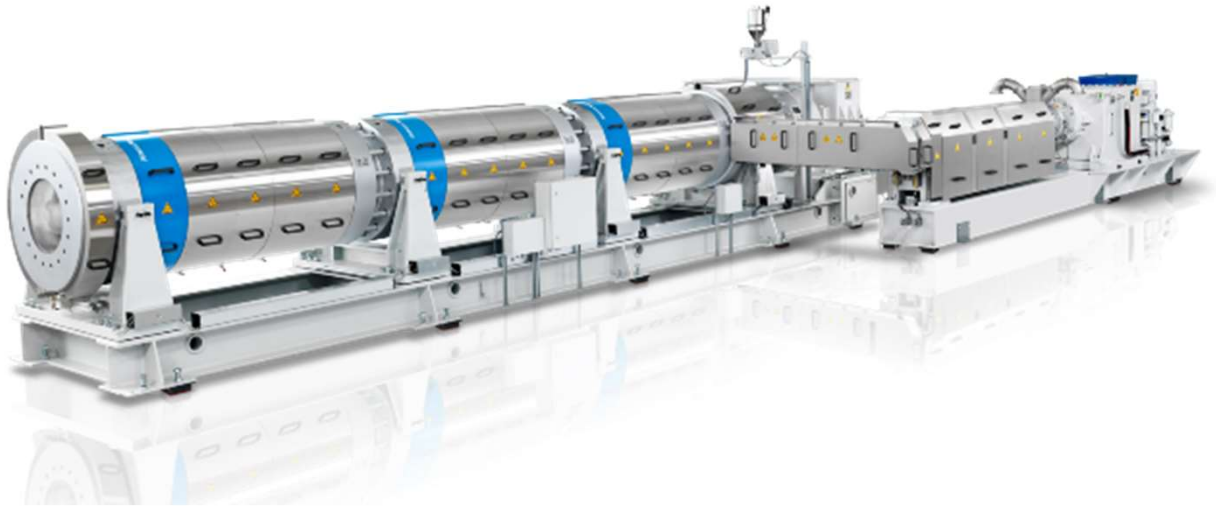
How does it work?



Techincal solutions by KME

Schaumtandex = Twin screw extruder + single screw extruder

- Schaumtandex is a tandem solution for processing EPS recipes consisting of a twin screw extruder and a single screw extruder
- Used for EPS foam extrusion lines with high throughputs up to 7.500 kg/h
- A subsequent cooling single screw extruder enables optimal process control and high cooling capacities
- The twin-screw extruder is recognized for its flexibility and recycling capabilities concerning various recipes and materials.

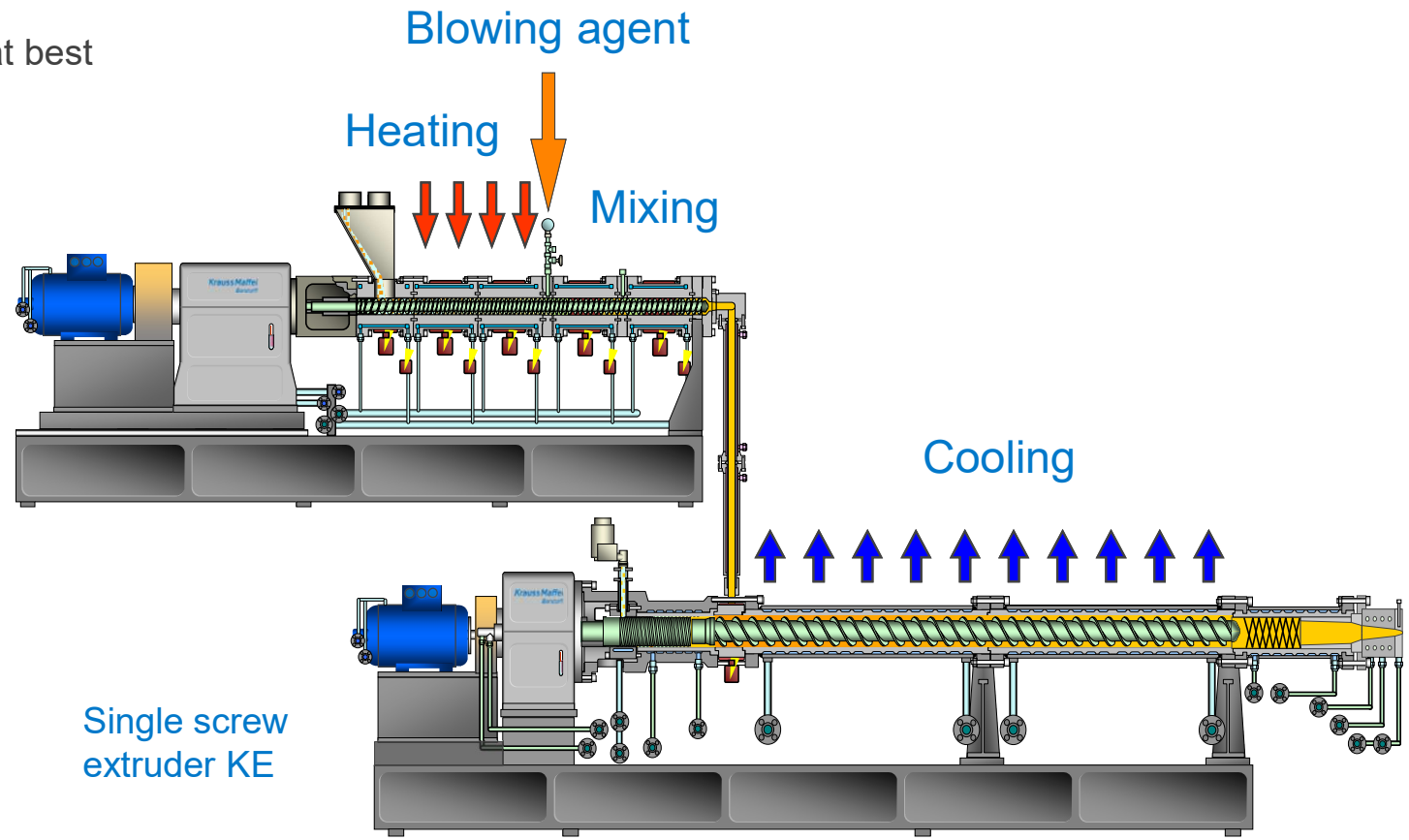


* Depending on the product

Foaming process

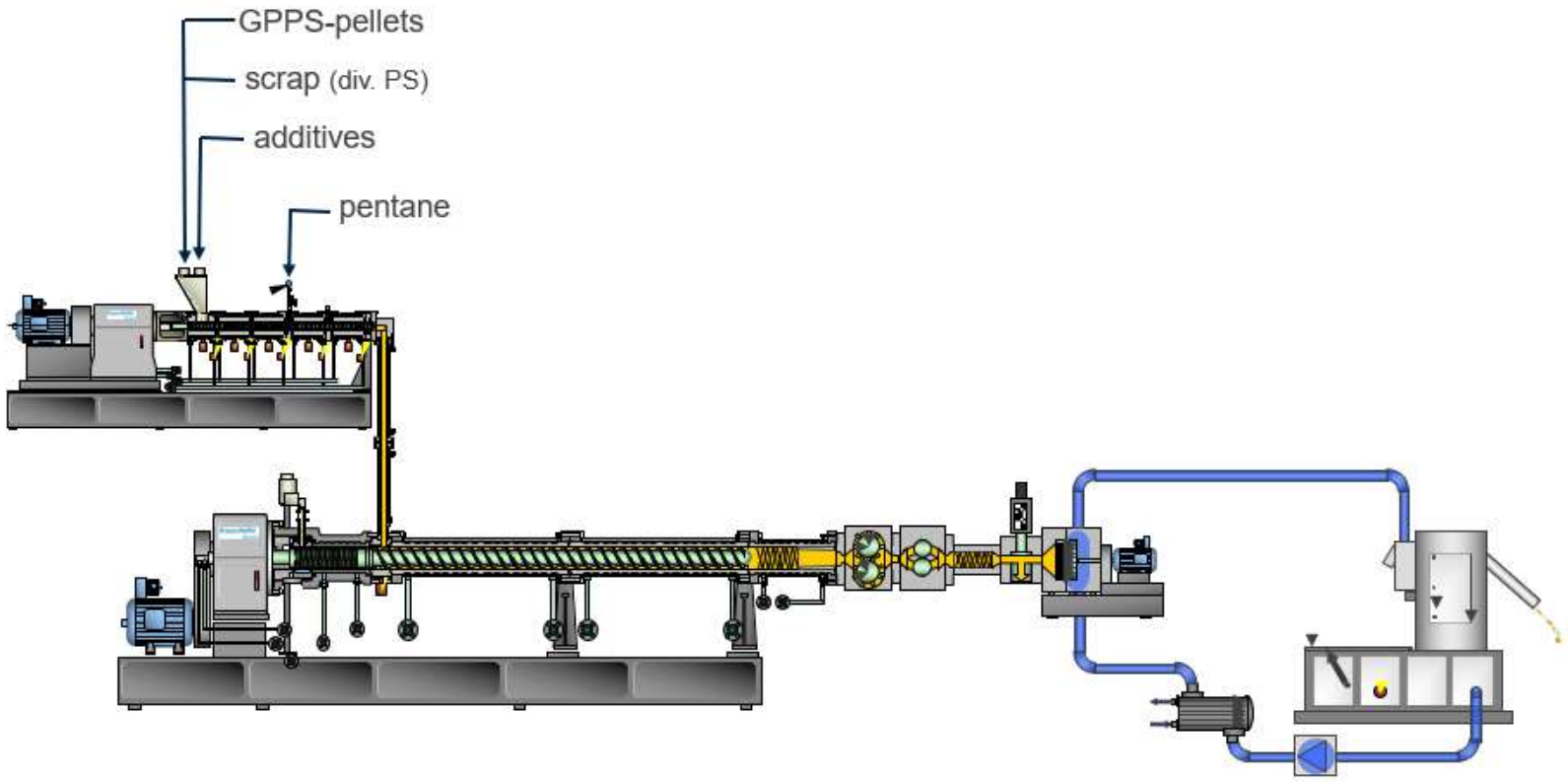
Schaumtandex ZE/KE (twin screw extruder + single screw extruder)

- Used for high throughputs at best cooling capacity



Schaumtandex

How does it work?



xEPS, extrusion process:

Die hole diameter > beads diameter > application

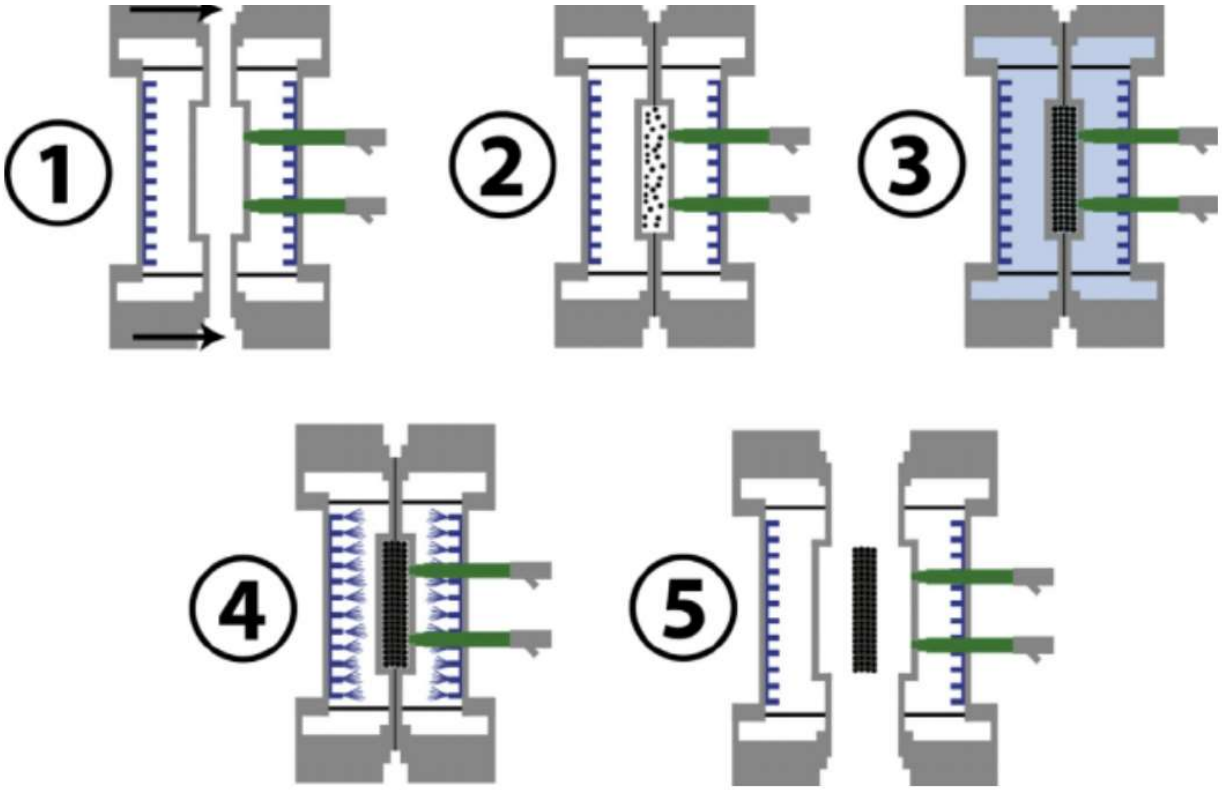
Die hole diameter	Average beads diameter	Range for beads diameter	Application
0,3 mm (only autoclave process)	0,6 mm	0,4 – 0,8 mm	Packaging, thin wall
0,5 mm	1,0 mm	0,8 – 1,4 mm	Packaging, boards
0,7 mm	1,4 mm	1,2 – 1,7 mm	Boards, blocks

Knife head

Die Plate

Subsequent processes

Production of moulded parts



Not KME scope of supply

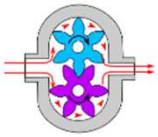
1. Closing
2. Filling the mold with EPS micro granules
3. Steaming (Pressure, temperature and steam speed need to be controlled)
4. Cooling
5. Ejection of molded part

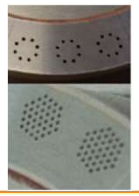
Source: EPP forum

Technical solutions by KraussMaffei

Scope of supply





Recycling

Dosing	Extrusion	Screen changer	Melt Pump	Start-up valve	Die plate	Pelletizer (under water)	Drier/ Separator	Classifier
– Polymers – Additives – Nucleating agent – Color	– Schaum-tandex – ZE + melt cooler – Blowing agent injection	– Protection melt pump and die plate	– Pressure build up	– Divert the melt during start-up	– Melt strand production	– Cutting off melt strands – Pressurized water flow	– Beads separated from water flow	– Classification of beads – Off-spec. recycling

Purchased components Inhouse manufacturing

GLOBAL MARKET TRENDS & CONCLUSION

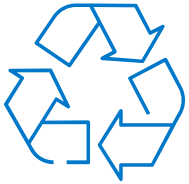
Recycling & Graphite for extruded EPS beads

Global market trends

Recycling & Graphite

Recycling

- Identify a suitable source for the recycling materials from EPS packaging and insulation such as fishboxes and construction waste.
- The waste products net to be processed in a recycling facilities before entering the co-rotating twin screw extruder
- Additionally, off-spec materials from suspension processes and start-up waste from the extrusion plant can be introduced into the process.
- The topic of recycling is a global concern, leading to a steadily increasing demand for modifying recycling solutions in our extrusion lines, nowadays up to 100%.



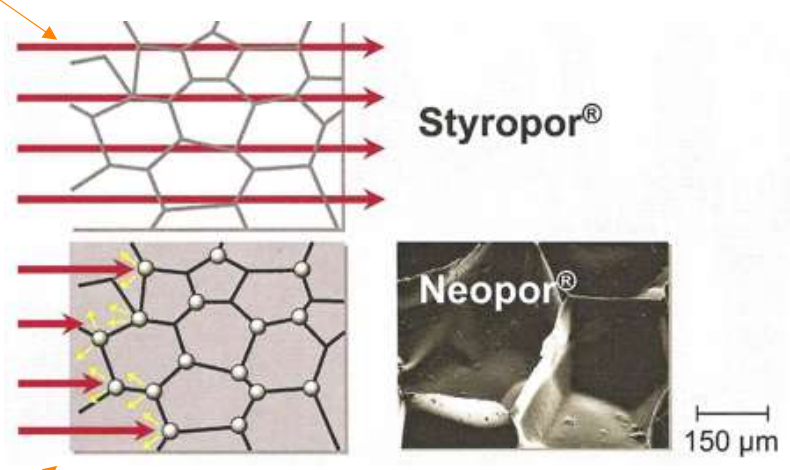
Graphite - blackEPS

- 1997 BASF enriched EPS with graphite particles → significantly enhancing the insulation properties of the foam.
- Color Appearance: more premium Look with a grayish or darker color.
- Applications: Construction applications where superior thermal insulation is required.
- Benefits: Improved insulation performance compared to standard EPS → Energy savings, reduced heating and cooling costs, and improved comfort in buildings.

Black xEPS beads

Example for improvement of thermal insulation properties by further additives

Low densities, thin walls (<15g/dm³)



IR-Absorber Graphite (<15g/dm³)

- 25% lower thermal conductivity (at a density of 10 g/L)
- 50% less material required for a thermal conductivity of 33 mW/(K·m).

Source: BASF, Dämmstoffeshop.de

Why KME is the right solution?

What do you get?

We work together with our customers to **develop both standard solutions and custom solutions** regarding materials, machine technology, and end products

In our innovation center, there are **18 extrusion plants**. Two of them are foam extrusion lines for physical foaming, aimed at advancing joint developments.

We have an **experienced team** that is open to discussions to optimize processes, offer suitable solutions, and think outside the box.

We develop extrusion lines ranging from **50 kg/h to solutions exceeding 7,000 kg/h.** Additionally, we design systems capable of processing up to 100% recycled material.

We're more than a machine builder: We're a strategic partner

Krauss Maffei
Pioneering Plastics

Please feel free to reach out to me at any time
- Thanks for your attention

Akif Ayaz

KraussMaffei Extrusion GmbH

Krauss-Maffei Straße 1
30880 Laatzen
Telefon: +49 (0)5102 8608 – 7758
Mobil: +49 (0) 1520 1861477
Email: Akif.Ayaz@kraussmaffei.com