QATM
QUALITY ASSURED

HOT MOUNTING | COLD MOUNTING | ACCESSORIES

MOUNTING GUIDE

part of VERDER scientific

CONTENT

MOUNTING

GENERAL INFORMATION ABOUT MOUNTING

GENERAL INFORMATION

When is mounting necessary?

» Samples are too small for grinding/polishing and hardness testing (low load/micro hardness): sample surface is enlarged by mounting, and thereby simplifies handling
» Simultaneous automatic preparation of larger sample quantities
» Preparation of coatings & layer thickness measurements
» Protection of edge zones
» For fragile and / or porous samples

THE PROCESS

Samples for materialographic analysis can be cold or hot mounted. Both methods are complementary and should not be evaluated as competing methods. The cold mounting materials on the market can be divided in chemical and light initiated polymeric systems.

CHOICE OF MOUNTING PROCESS

Pressure and heat may alter the microstructure of a sampled material, which leads to a wrong result of the analytical process. Pores and gaps in the sampled part must be filled completely with mounting material. The mounting technique, mounting material and mounting method must be adjusted to the analytical goals and present laboratory equipment.

COMPARISON OF MOUNTING PROCESSES

	Cold Mounting (chemical curing)	Cold Mounting (light curing)	Hot Mounting
Materials	all materials, porous samples, parts with shaded areas, cavities, cracks, heat-sensitive materials	simple part geometries, standard samples, heat-sensitive materials	simple geometries, heat and pressure resistant materials
Machines	fume cupboard, pressure unit, device for vacuum impregnation	UV-mounting device	hot mounting press
Mounting materials	acrylics (MMA based or modified acrylates), modified polyester resins, epoxy resins	modified acrylics	phenolic resins, PMMA, epoxy resins, diallylphthalates
Fillers	ceramics, copper, graphite, minerals	none	ceramics, diallylphthalates, graphite, wood-flour
Temperature	35 °C - 120 °C	70 °C - 90 °C	150 °C - 200 °C
Time/process	5 min to approx. 24 h	1 - 5 min	5 - 15 min
Handling	2 to 3 component systems, precise working essential	1 component systems, very easy handling	1 component systems, easy handling
VOC emission	strong, use of suitable fume-cupboard suggested	low, use of external suction unit suggested	none
Repeatability	mediocre	good	good
Mould diameters	free choice of mould size and shape	free choice of mould size and shape	restricted, depending on hot mounting press
Mounting mould	silicone rubber, PTFE, PP, PE	PP, PE	-
Cost	low initial cost, high subsequent costs	medium initial cost, high subsequent costs	high initial cost, low subsequent costs

Parameters to be considered during mounting

Sample material	Mounting resin
heat-, pressure-, UV-resistance	curing time
sample throughput	shrinkage, edge retention
size and geometry	transparency
hardness	hardness and chipping behavior
porosity	mounting technique
analytical goals	

PRACTICAL TIPS

GENERAL INFORMATION ABOUT MOUNTING

GENERAL INFORMATION

The following parameters have to be considered in order to avoid the formation of edge gaps between sample material and mounting material:

» Sample geometry
» Arrangement of samples in the mounting mould
» Arrangement of samples in the mounting mould
» Polymerization behaviour and hardness of the resin
» Thermal conductivity of sample material:
the risk of gap formation increases the faster the mounting material cools down (take special care with methyl acrylates!)

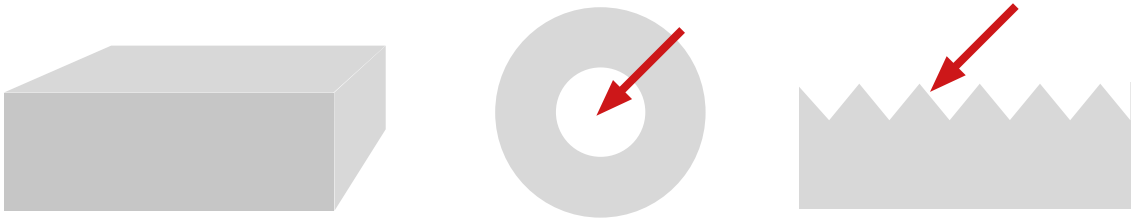
GOOD TO KNOW

Sample Geometry

Sample geometry and arrangement of the samples and/or the distances of the samples to the mounting mould can lead to different results.

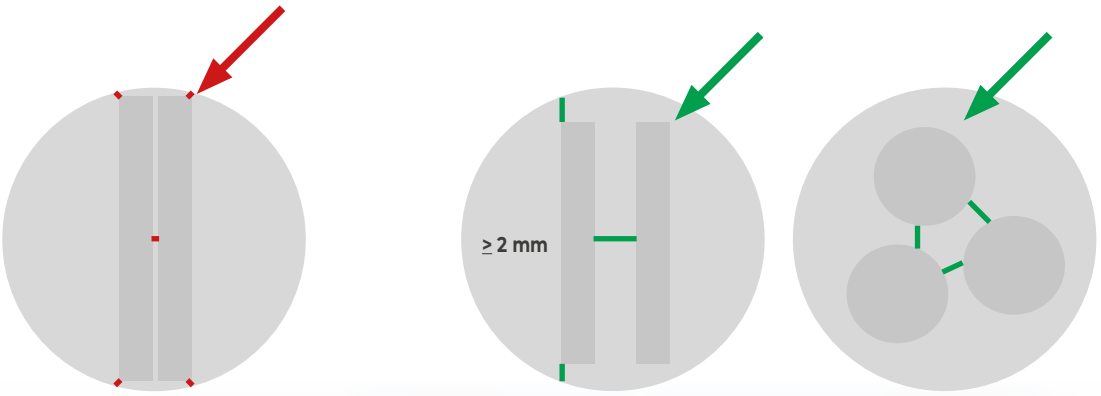
Insufficient separation between the individual samples or to the edge of the mould can cause gap formation and result in cracks (try to keep a distance of approx. 2-3 mm).

Geometry

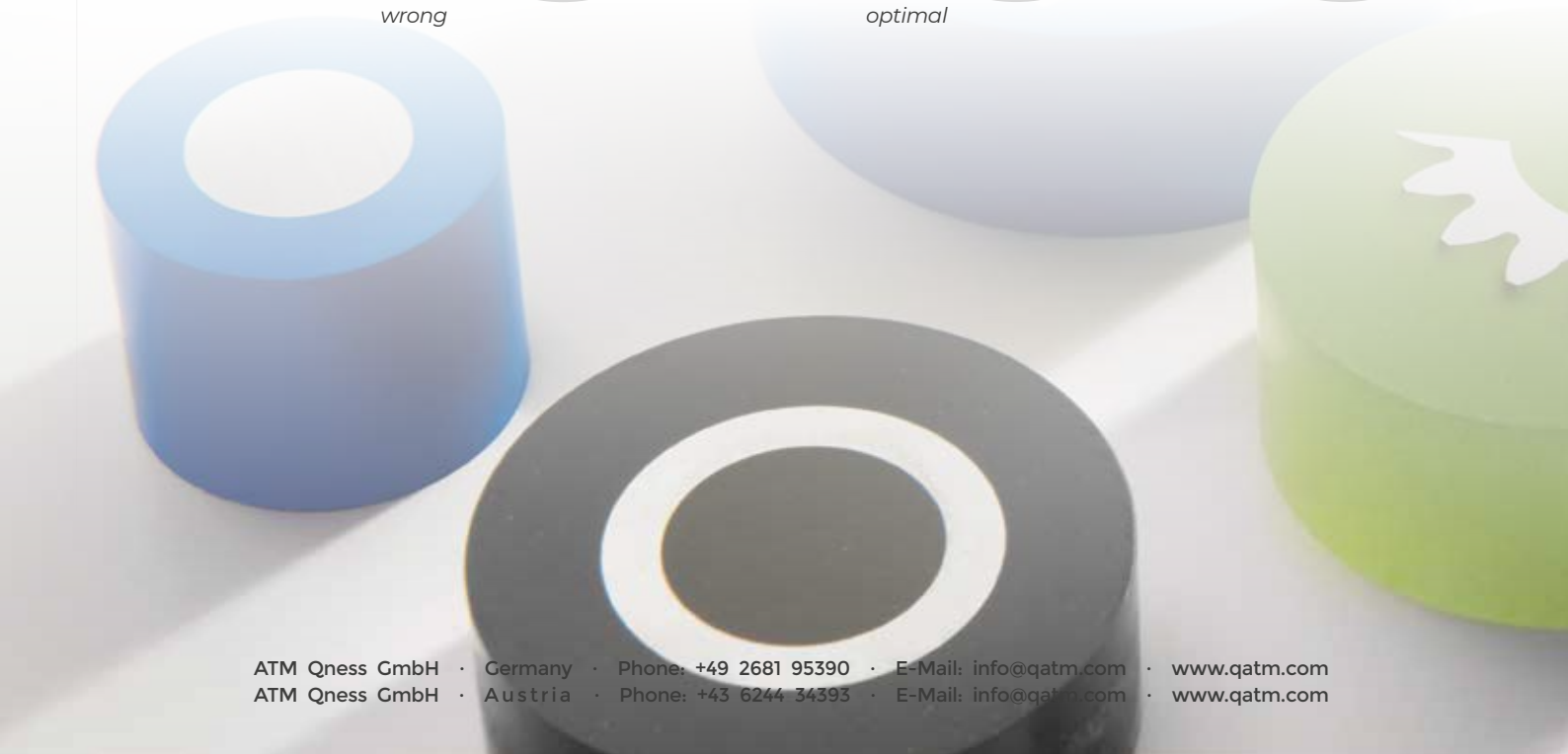


simple *difficult*

Distance sample - mounting mould / sample - sample



wrong *optimal*

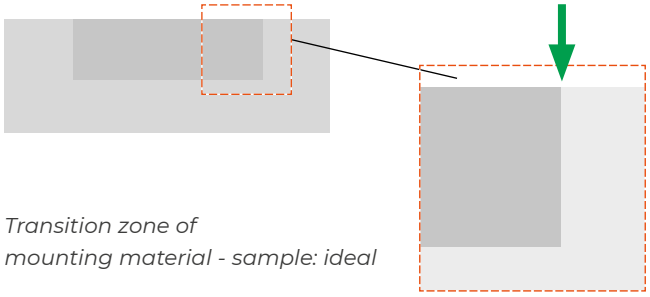


APPLICATION-RELATED INFORMATION

Hardness
Correct preparation with edge retention and protected edge zones needs the use of a mounting resin with a suitable hardness.

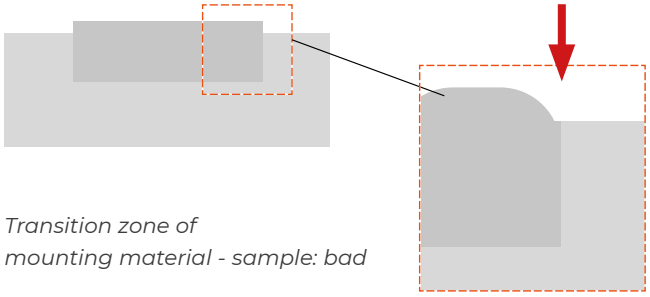
Transition zone of mounting material and sample

Same hardness of sample and mounting material



Transition zone of mounting material - sample: ideal

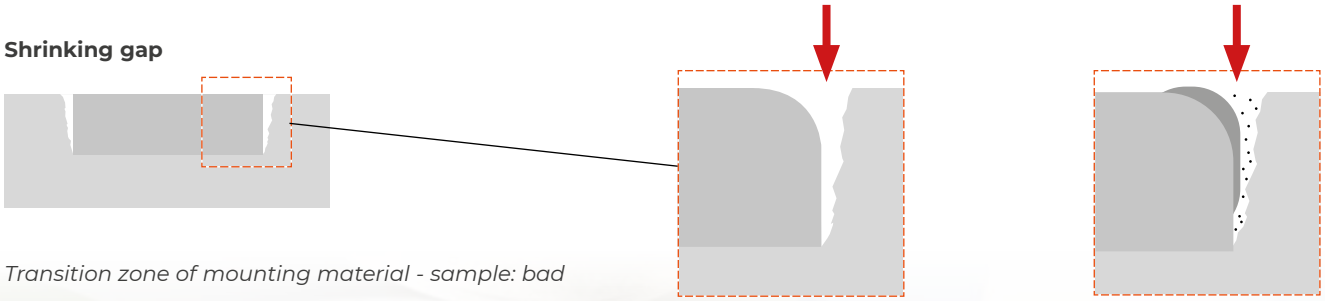
Different hardness between sample and mounting material



Transition zone of mounting material - sample: bad

Gap formation
Mounting should show minimized gap formation. Gaps at edges and rounded edges increase the risk of contamination with dirt and abrasives or polishing particles; this can cause deterioration of preparation results.
Subsequently flowing etching agent or cleaning alcohol might cause falsifying re-etchings or discoloration in the edge areas.

Shrinking gap



Transition zone of mounting material - sample: bad

COLD MOUNTING

The term cold mounting summarizes all mounting methods, which do not depend on the application of a hot mounting press. Furthermore, it must be differentiated between classic and UV-initiated cold mounting processes.

UV BASED COLD MOUNTING

UV based cold mounting recently appeared on the materialographic market. Modified acrylic resins are applied for this process. The convince though very easy handling (1 component material), transparency and extremely short mounting times of 60s to 5 min. Light curing cold mounting is the most throughput oriented mounting technique. However, the used mounting materials do not contain any fillers, which restricts the application of these products to samples of low to medium hardness. The mounting of routine samples, or the analysis of core microstructures is also feasible for hard materials.

COLD MOUNTING

The classic cold mounting process employs mounting materials that consist out of two or more components. Usually two to three components (liquid-powder or liquid-liquid systems) must be mixed in specific amounts. A proper dosing and good homogenization of the components are essential for the process. Depending on the polymer system polymerization-temperatures, pot-life and curing times deviate strongly. The addition of fillers enables the adjusting of hardness, shrinkage and contrasting behavior of the mounting material. Cold mounting resins are mainly suggested for pressure- or heat-sensitive samples. The high degree of freedom of the used mounting moulds enables the processing of very different sample sizes and geometries. The classic cold mounting remains the most versatile mounting technique on the market. With epoxy-resins, acrylic resins and modified polyester resins are large spectrum of cold mounting materials is present. Therefore, it is important to choose the fitting consumables based on the properties of the sampled material. It should be kept in mind, that the process is not very cost effective, and a suitable fume cupboard is needed if a high sample throughput is desired.

SELECTION OF COLD MOUNTING MOULDS

Cold mounting moulds are available in PTFE, silicone, polypropylene and polyethylene. All cold mounting moulds are reusable. Moulds with removable bottom make it easier to detach the sample from the mould.

PTFE High mechanical stability is ideal for automatic grinding and polishing.

Silicone Silicone moulds lose their round shape and turn oval after beeing used several times. This can result in disadvantages for automatic individual pressure preparations. When polyester resins are used, sticky places can occur at the edge of the sample as a reaction of mounting material in combination with the silicone mould.

Polypropylene and polyethylene In older moulds the removable bottom is often no longer flat. When several small parts are mounted in one sample, different grinding planes can be ground unintentionally at the same time, depending on the position of the individual sample.

Suitability of the mounting mould

Methods	Mounting material	PTFE opaque	Polypropylene PP transparent	Polyethylene PE transparent/opaque	Silicone rubber opaque
Cold mounting	Methacrylates, polyester	xxx	xx	x	xx
Vacuum	Epoxy resins	-	xx	xx	-
Pressure	Methacrylate	xxx	xx	x	xx
Light curing	Modified methacrylates	-	xxx	xx	-

xxx - very well suited, xx - well suited, x - less suitable, - not suitable

COLD MOUNTING

OVERVIEW COLD MOUNTING MATERIAL

	Modified polyester	Acrylic resins				Epoxy resins		Acrylic resins
Product	**KEM 15 plus**	**KEM 20**	**KEM 30**	**KEM 35**	**KEM 60**	**KEM 90**	**KEM 92**	**KEM 50 UV**
Based material	Methylmeth-acrylate, styrene	Methylmeth-acrylate	Methylmeth-acrylate	Methylmeth-acrylate	Tetrahydrofurfuryl-2-methacrylate	Epoxy resin	Epoxy resin	modified acrylate
Filler	Mineral, PMMA	PMMA	PMMA	Ceramic, PMMA	Mineral, PMMA	-	-	-
Hardness (Shore D)	85	84	85	87	85	79	81	83
Chipping behavior	good	good	good	very good	good	sufficient (smearing)	good	sufficient (high removal rate)
Removal rate	very low	medium	medium	very low	low	high	medium	high
Chemical resistance	good	good	good	good- sufficient (heated etchants)	good	good - sufficient (heated etchants)	good - sufficient (heated etchants)	good
Transparency	opaque	good (curing in pressure unit)	opaque	opaque	opaque	very good	very good	very good - good
Curing time	approx. 25 min	approx. 15 min	approx. 5 min	10-15 min	approx. 10 min	16-24 h	12-13 h	1-5 min
Curing temperature	approx. 85-100 °C	approx. 100-120 °C	approx. 95-110 °C	approx. 85-100 °C	approx. 95-110 °C	approx. 60 °C	approx. 35 °C	approx. 70-90 °C
vacuum impregnation	no	no	no	no	no	yes	yes	no
Curing under overpressure	yes	yes	yes	yes	yes	no	no	no
Mixing ratio	vol.%	vol.%	vol.%	vol.%	wt.%	wt.%	wt.% or vol.%	-
Application	Materials of medium to high hardness, analysis of marginalized layers and coatings	Soft to medium hard materials, targeted preparations	Routine samples, materials of low to medium hardness	materials of high and very high hardness, analysis of marginalized layers and coatings	Routine samples, soft to medium hard materials, wide application range	porous materials, materials of low hardness, targeted preparation, complex geometries	porous materials, materials of low hardness, targeted preparation, complex geometries	Routine samples, soft to medium hard materials, simple geometries, targeted preparation

Tips for Cold Mounting

Epoxy resins

» Epoxy resins can be cured at elevated temperatures (up to 60°C). This drastically reduces the curing time on the cost of yellowing and enhanced shrinkage. Of course, higher polymerization temperatures must be tolerated.
» Carefully mix resin and hardener in the cup - avoid air inclusions.

Acrylic resins

» Pour acrylic resins into the mould immediately after mixing, as they harden very quickly.
» Acrylic resins are not suitable for vacuum systems or disposable mounting moulds.
» Coating the sample with liquid hardener before pouring in mounting material can improve the edge retention.
» The use of a pressure vessel can further reduce gap formation..

COLD MOUNTING

MOUNTING PROCESS

PROCESS SUPPORT

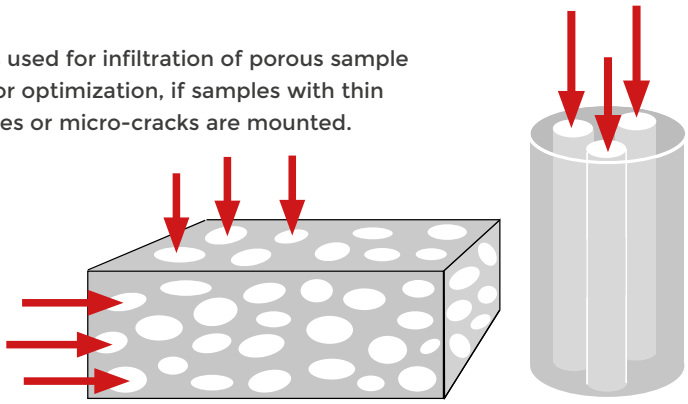
The mounting process can be supported by different methods. Characteristics of the respective sample material have to be considered.

VACUUM PROCESS

Mounting under vacuum is only possible with **epoxy resins**. Therefore, a vacuum appliance is required.

Infiltration unit

This method is used for infiltration of porous sample material and for optimization, if samples with thin bores, fine pores or micro-cracks are mounted.



Scheme: infiltration of porous material or thin bores

To achieve an optimal mounting or infiltration, a vacuum can be applied (venting of the sample before casting the epoxy resin). **Warning:** vacuum which is set too high and applied too long, influences the polymerization and might cause uneven curing, leading to different results.

The dosage of epoxy resins should be strictly complied with and therefore always be carried out according to weight-% (laboratory balance).

Errors and causes	
Mounting material too brittle or too soft	Mind exact dosage of resin and hardener.
Strong bubble formation in the mounting material	Vacuum too long and/or too high; recommendation: 0.6-0.8 bar, about 2-3 min.
Infiltration not complete	Leave vacuum on longer.

GOOD TO KNOW

Colouring of Samples

Epoxy resins can be coloured by additives.
This is an advantage compared to other mounting materials.

PRESSURE PROCESSES

Mounting with pressure is only possible with **methyl-methacrylates.**

A simple pressure appliance / technomat for compressed air connection (approx. 5-6 bar) is required.

Methacrylates without a filler additive cure transparently under pressure. The formation of microbubbles is avoided by the application of a pressure of 2-2.5 bar.

The dosage of MMAs can be handled generously, i.e. the dosage by volume-% (dosing spoon) is sufficient.

Errors and causes	
Bad transparency	Mixing time too long. Insertion into pressure appliance too late. Pressure too low. Mixing ratio wrong.

COLD MOUNTING WITH LIGHT CURING POLYMERS

Currently only **modified acrylics** are used as the base material for light curing mounting materials. The application of light curing epoxy-resins is extremely uncommon due to the high layer-thicknesses in materialographic application. The initiation of the curing reaction is triggered by UV radiation with a wavelength of 350 to 400 nm. The process is restricted to pore and cavity-free sample geometries, since the mounting materials only cures in irradiated areas. A good example for this product class is the very fast curing, 1 component system KEM 50 UV. It is transparent, like most light curing acrylics. Due to the scattering effects, the addition of inorganic fillers (e.g., glass beads) is only feasible in very small amounts. This restricts the methods application to materials of low to medium hardness. The edge retention is, in comparison to filled acrylics like KEM 35, mediocre. Therefore, the preparation of marginalized layers or coatings is not suggested with this mounting material. The used UV initiators (usually, aromatic, organic compounds) need UV radiation of a certain wavelength to start the curing reaction. This leads the used of UV – LEDs that have ben optimized for the use with a certain initiator system. This is necessary to fully utilize the mounting materials potential. Only a few UV-curing devices are currently present on the market. QATM's Qmount is a UV-mounting device that has been optimized for the curing of resins with a wavelength of 365 nm.

Errors and Causes	
Insufficient or no curing	Check LED´s performance, use UV transparent PP/PE moulds, too short curing time, wrong LED type used
Parts of the sample´s interior are improperly cured	No sufficient irradiation, cure layerwise, longer irradiation times, choose other mounting methods, use proper moulds
Backside of the sample is deformed	Too high UV-intensity, sample may be too high for the irradiation chamber, lighting is inhomogeneous

COLD MOUNTING

UV MOUNTING DEVICE

QMOUNT

The Qmount is a UV mounting device optimized for the application with KEM 50 UV. Long lasting UV-LEDs with slim emission spectrum centered around 365 nm are employed. With a curing cross-section of 260x200 mm it is the largest laboratory device present on the market (16th June 2021). An attachable suction unit and a robust aluminum housing make it well suited for the application in an industrial environment. It was optimized for KEM 50 UV and enables very short curing times of 60 s.

Qmount

Features
Qmount
UV mounting device
» UV mounting in the shortest possible time (60 seconds)
» Highly efficient, long-life LED technology
» Robust machine design
» Easy handling
» Connectable suction unit (optional)

Mounting moulds
Polypropylene round, Ø 25 mm / H 27 mm
Polypropylene round, Ø 30 mm / H 27 mm
Polypropylene round, Ø 40 mm / H 27 mm

GOOD TO KNOW

Tips for UV mounting

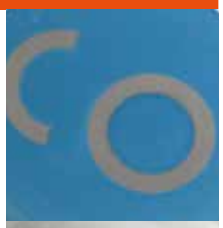
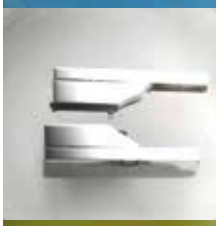
Always use UV transparent moulds machined form PP or PE to guarantee the optimal curing of the mounting material.

Clean the cured samples by immersing them in ethanol, to obtain a good surface finish. The residues of the O_2-stablizers are removed by the solvent.

Mount large samples, or samples used for longitudinal sectioning in multiple process steps. The layerwise curing of the mounting material is possible.

COLD MOUNTING

COLD MOUNTING MATERIAL

Mounting material	Recommended application	
KEM 15 plus	methyl-methacrylate, blue, opaque, high edge retention 2-component system: powder + liquid (1.5:1 [Vol.-%]) » for mountings with high edge retention, edge examination, medium-hard to hard materials » CT: approx. 20 min.	
KEM 20	methyl-methacrylate, transparent (pressure appliance) 2-component system: powder + liquid (recommendation 1:1 [Vol.-%]) » for transparent mounting (pressure vessel), targeted preparation » CT: approx. 12 min.	
KEM 30	methyl-methacrylate, green, transparent 2-component system: powder + liquid (2:1 [Vol.-%]) » for semi-transparent mountings (pressure vessel), routine work, soft to medium-hard materials » CT: approx. 5 min.	
KEM 35	methyl-methacrylate, light green, opaque, good edge retention 2-component system: powder + liquid (1.5:1 [Vol.-%]) » for mountings with good edge retention, edge examination, medium-hard to very hard materials » CT: approx. 12 min.	
KEM 60 (MMA-free)	base tetrahydrofurfuryl-2-methacrylate with mineral filler, red, opaque 2-component system: powder + liquid (2:0.9 [weight-%]) » universal usage » CT: 15-18 min.	
KEM 90	epoxy resin, clear, transparent 2-component system: resin + hardener (2:1 [weight-%]) » suitable for vacuum impregnation, sensitive and brittle materials » CT: approx. 16 - 24 h	
KEM 92	epoxy resin, clear, transparent 2-component system: resin + hardener (4:1 [weight-%]) » for vacuum impregnation, brittle, and sensitive material » CT: approx. 13 h	

GOOD TO KNOW!

Methyl-Methacrylate

Methyl-methacrylates may outgas over a longer period of time -
this can delay the curing time!

	Mounting material	Recommended application
	KEM 50 UV	Light curing acrylic resin, clear, transparent 1-component system » for standard samples, soft to medium hard materials » CT: 1-5 min
	Technovit 4000 SET	**methyl-methacrylate, white, opaque 3-component system: powder + liquid 1 + liquid 2 (3:2:1 [Vol.-%]) » for mountings with good edge retention, edge examination, medium-hard to hard materials » CT: approx. 8 min.**
	Technovit 5000	**methyl-methacrylate, copper-brown (bubble-free in pressure appliance) 2-component system: powder + fluid (20 g:13 ml [Weight-%]) » conductive, for SEM examinations » CT: approx. 7 min.**

CT = Curing time

Characteristics of cold mounting material

	Material	Characteristics	Application	Transparency	Edge retention	Gap formation	Curing time
KEM 15+	methyl-methacrylate	blue, opaque, high edge retention, high hardness	edge examinations, medium-hard to hard materials	-	xxx	very low	<20 min
KEM 20	methyl-methacrylate	transparent (curing under overpressure)	transparent mountings, targeted preparation	xxx	x	medium	<15 min
KEM 30	methyl-methacrylate	semi-transparent (curing under overpressure)	routine mountings, soft to medium-hard materials	x	x	medium	<5 min
KEM 35	methyl-methacrylate	light green, opaque, good edge retention	edge examinations, medium-hard to very hard materials	-	xx	very low	<15 min
KEM 60	methacrylate	red, opaque, MMA-free	universal applications	-	x	medium	<20 min
KEM 90	epoxy resin	transparent, low viscosity	sensitive and brittle materials, vacuum impregnation	xxx	xxx	very low	<24 h
KEM 92	epoxy resin	transparent, low viscosity, colorless	Vacuum impregnation, brittle and heat sensitive materials, porous materials, soft materials	xxx	xxx	very low	< 13 h
KEM 50 UV	modified acrylic	transparent, light curing, colorless	Routine samples, soft to medium hard materials, targeted preparation	xxx	x	medium	< 1 min

xxx - very well suited, xx - well suited, x - less suitable, - not suitable

HOT MOUNTING

GENERAL INFORMATION ABOUT HOT MOUNTING

HOT MOUNTING PROCESS

The hot mounting process means that materialographic samples are melted and compacted in finished ground resin granulate inside a closed cylinder. This process is controlled in a hot mounting press and the samples are encapsulated in a plane-parallel manner. The parameters selected - temperature, pressure and time - depend on the machine specifications themselves and mounting material/resin.
The hot mounting technique ensures high edge retention, protects the sample edges and is suitable for a high sample volume. However, it is not suitable for heat- or pressure-sensitive samples. In case of electronic components (solders/composites) or pressure-sensitive material, e.g. wires or sheets with small cross-sections, the time of pressure application can be controlled in order to minimize the risk of false mounting.
In the hot mounting process, the samples are placed in the press cylinder of the mounting press on the lower ram, which is then filled with special resin granulates (diverse bakelites, duroplasts or thermoplastics). The granulates are melted under pressure and heat, so that all cavities of the mounting mould are filled. Hot mounting means the sample is mounted with minimum gap formation, depending on mounting material. After cooling it is ready for further preparation. Combined with respective mounting material, our hot mounting presses are extremely popular by their very high edge retention and high sample throughput.

The benefits

» No direct contact with chemicals
» Good edge retention
» High degree of hardness of the mounting material
» High plane parallelism
» Easy sample marking by engraving, labelling

SOME USEFUL TIPS

Mould separating agent

Especially of epoxy resins, or other mounting materials with low shrinkage and gap formation are used a strong adhesion of the mounting materials to the mould can be observed. Therefore, separating agents can be applied on the mould to reduce the cleaning effort of the hot mounting press. Commonly silicon pastes, spray or suitable metal-stearates are used to prevent the adhesion of the sample on the mould. The mould separating agent must be applied with caution, since it may lead to enhanced gap formation if too much is applied on the lower ram.

Mould diameter

The spacing between sample and mould should be at least 3 mm to prevent cracks and breakouts of the mounting material. Especially sharp-edged samples are prone to these errors, due to internal stresses in the shrinking polymer.

Small samples

Small and thin samples must be fixed with mounting aids. Sometimes adhesives must be applied for fixation. Even though the pressure is applied homogeneously small samples tilt and shift during the hot mounting process if the are not fixated properly.

Clean samples

The least gap formation is achieved with cleaned, dried, and fatless samples. Therefore, samples should be cleaned with ethanol, petroleum ether or other suitable solvents. A mechanic cleaning, e.g., using microfiber cloths, should be carried out properly. Sometimes the use of an ultrasonic bath is advised.

Preheating

In the case of porous and/or pressure-sensitive samples, such as minerals, etc., the mounting material can be heated and softened before applying pressure. Preheating with the special programs in the OPAL mounting presses is also recommended when using thermoplastic mounting materials, as e.g. Thermoplast.

Heat and pressure sensitive samples

Brittle materials and heat sensitive alloys prove a challenge during the hot mounting process. To prevent a thermal shock induced cracking, or irreversible microstructural changes the use of a cold mounting method is suggested. If this is not possible the following options remain:
The pressure is applied after the hot mounting press has reached the target temperature, which leads to an already softened hot mounting material which shows a better flowability. This reduces the load on the sample during the pressure application, which is good for brittle materials. Furthermore, reduced heating and cooling rates should be used, even though a longer mounting time is necessary. If possible, temperature and pressure should be reduced. 100 bar and 150 °C can be assumed to be the lower threshold values of commercial hot mounting presses.

HOT MOUNTING MATERIAL

Adding of fillers influences hardness, shrinking behaviour and mechanical workability. The Duroplast group cures at a higher temperature in the range of 130–180 °C.

Thermoplastics melt at temperatures of 130–180 °C and cure during the cooling phase. In comparison to Duroplasts this significantly increases the cooling time depending on the diameter of the mounted sample..

Characteristics of Hot Mounting Material

Mounting material	Recommended application	Basis / filler	Hardness (shore D)	Removal rate (grindability)
Bakelite (black, red, green)	routine mountings, soft to medium-hard materials, good for filling up	phenolic resin/ wood flour	92	medium
EPO black	high edge retention, edge examination, medium-hard to hard materials	epoxy resin/ mineral and glass fibre	93	very low
EPO-Max	high edge retention, edge examination, medium-hard to hard materials easy cleaning of mould and ram due to low adhesion	epoxy resin/mineral	93	very low
Duroplast black	conductive, SEM examinations, electrolytic polishing	phenolic resin/ graphite	89	medium
Duroplast blue	high edge retention, edge exami-nation, soft to medium-hard materials, recommended for grinding stones	diallylphtalate/ glass fibre	92	low
Thermoplast	transparent mounting, target preparation, sensitive materials, well-suited for filling up, marking	acrylic resin	86	medium

GOOD TO KNOW

Parameters	Bakelite	EPO	Duroplast	Thermoplast
Polymerization range	120 - 200 °C	130 - 180 °C	130 - 190 °C	130 - 195 °C
Heating time	5 - 8 min*	5 - 8 min*	5 - 8 min*	5 - 8 min*
Cooling time	5 - 8 min*	5 - 8 min*	3 - 6 min*	7 - 10 min*
Pressure	150 - 250 bar*	150 - 250 bar*	150 - 180 bar*	160 - 195 bar*

** depending on the diameter of the mould assembly: the larger the diameter of the mould, the more pressure and time must be applied*

Errors and causes

Mounting material is coarse-grained and rough. Discoloration when cleaning with ethanol.	Sample too high. Not enough granulate. Mounting material not cured. Check temperature.
Gap formation despite of mounting material with high edge retention.	Check pressure/temperature settings. Sample has not been cleaned before mounting. In case of a two-layer mounting: check sample arrangement (cause: fine-grained filling granulate can seep through granulate with high edge retention).
Milky stains and/or cracks when using acrylic resin.	Check cooling temperature (often too low).

HOT MOUNTING

HOT MOUNTING PRESSES

THE OPAL HOT MOUNTING PRESSES

The hot mounting presses OPAL mount samples in a very short time - fully automatic, fully hydraulic and water-cooled. The OPAL 410 is fitted with the proven QATM bayonet closure, whereas the fully automatic sliding closure of Opal 480 allows quick and easy opening/closing of the mould assembly. The wide range of round (from 25.2 to 70 mm) and rectangular (30x60 and 40x60 mm) mould assemblies enables optimum moulding. The mould assemblies are easy to change. Spacers in different sizes allow for time-saving double mounts.

The appliances are environmentally friendly, operating noise is minimized and, thanks to the powder-coated aluminium construction, very robust and durable. The infinitely variable cooling curve allows you to get very low water consumption with a longer cooling time.

The clear LCD operation panel of OPAL 480 is user-friendly. Up to 18 free configurable mounting processes can be stored and retrieved at any time. In addition to standard operation, three additional pressure methods can be selected:

1. Pressure increases in parallel with the pre-heating phase (ideal for mounting hollow samples)
2. Pressure increases after the pre-set temperature is reached (e.g. to produce almost gap-free mounts of complex geometries)
3. Pressure increases during cooling (e.g. to prepare transparent samples).

Comparison of characteristics

Opal 410	Opal 480
Automatic hot mounting press	**Automatic hot mounting press**
» Fully hydraulic pressing process	» Fully hydraulic pressing process
» Automatic water cooling (with water saving function)	» Automatic water cooling (with water saving function)
» Bajonet closure	» Sliding closure
	» Fully automatic, electronic control
	» Large, clearly arranged LCD display and optimized user interface
	» 18 programs to save with free configuration
	» 3 different modes for pressure to select
Mould assembly	**Mould assembly**
Ø 25.2 mm (approx. 1")	Ø 50 mm
Ø 30 mm	Ø 60 mm
Ø 32 mm	Ø 70 mm
Ø 31.75 mm (1¼")	30x60 mm
Ø 38 mm	40x60 mm
Ø 40 mm	

Opal 410

Opal 480

HOT MOUNTING

MODULAR HOT MOUNTING PRESSES

Qpress 50

The modular design of the innovative hot mounting press Qpress 50 allows fast and simultaneous mounting of different materialographic samples. In order to suit specific customer requirements with regard to material and size of different samples, the appliance can be optimally configured after selection of the Qpress 50-2 or 50-4 variant.

The basic appliance includes a control panel and an integrated pressing unit and can be upgraded with 1 or 3 additional pressing units Qp 50. These are separated from the base device and can be added later. Thus, it is possible to process samples of up to 4 different diameters in one device at the same time. The Qpress 50 allows fast mountings with low power consumption and a very high ease of use.

GOOD TO KNOW

Mould assemblies with chamfer

When mounting samples for subsequent manual preparation, it is recommended to use mould assemblies with chamfer. Chamfered samples are easier to handle as they do not tilt during manual grinding and polishing and will not damage the polishing cloth.

Characteristics

Qpress 50

Modular hot mounting press (2-4 pressing units according to the equipment)
» Fully hydraulic pressing process
» Automatic water cooling (with water saving function)
» Sliding closure with one-hand closure system
» Dust Guard: during filling of mould removal of fine dust with connected vacuum cleaner
» Dirt trap catches excess mounting material
» 7" touch display with innovative control software
» High flexibility due to customized preheating function, cooling modes, maintenance tasks
» User accounts with definable access rights
» Housing made of solid, powder-coated steel construction

Mould assemblies
Ø 25.2 mm (approx. 1")
Ø 30 mm
Ø 1¼" (~32 mm)
Ø 1½" (~38 mm)
Ø 40 mm
Ø 50 mm

Qpress 50

HOT MOUNTING

PRACTICAL TIPS

	DUROPLASTS				THERMOPLAST
	Phenolic resin	Phenolic resin	Dialylphtalate	Epoxy resin	Acrylic resin
Product	Bakelite black, red, green	Duroplast black	Duroplast blue	EPO black	EPO-Max	Thermoplast
Routine examinations of soft to medium-hard materials **Samples without edge zones** **Mounting of sample material**	xxx	-*	-*	-*	-	-
Examination of material with high hardness **Hard edge layers** **Difficult geometries**	x	-	xxx	xxx	xxx	-
All examinations **Planar grinding with corundum or SiC grinding stones**	-	-	xxx	-	-	-
Soft materials **Targeted preparation** **Thin sections**	x	-	-	-	-	xxx
SEM examinations **Electrolytic polishing**	-	xx	-	x	x	-

xxx - very well suited, xx - well suited, x - less suitable, - not suitable, - over performing for this application*

GOOD TO KNOW

Tips for Hot Mounting

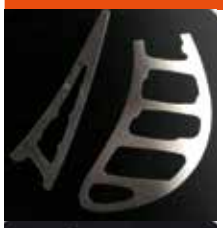
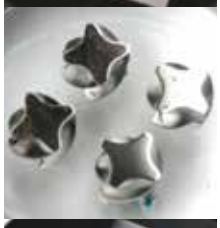
For better edge retention and minimized shrink gaps, the mounted samples should be cooled down to room temperature under pressure before they are removed from the mounting press.
The cause for insufficiently cured mounted samples can be too much moisture in the mounting material. Therefore, always make sure that the container is properly closed after use.

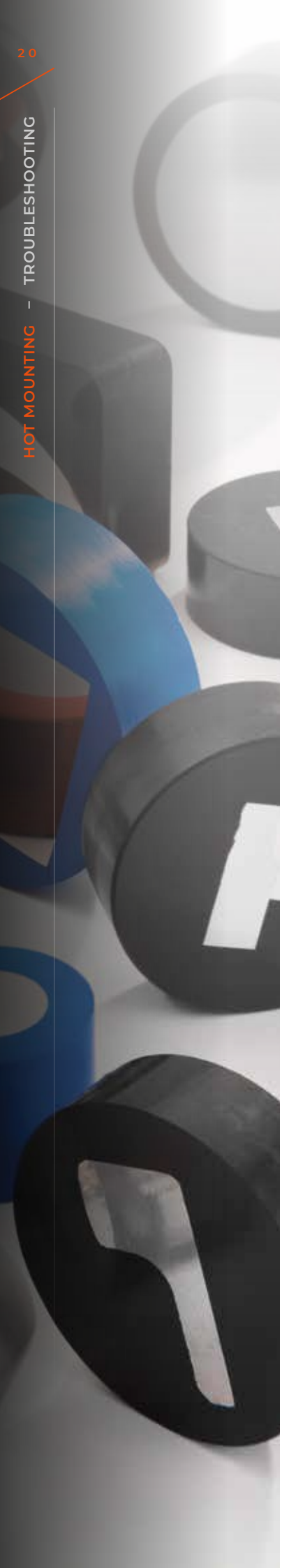
Warning: Although double mountings are possible with each mounting press, the finished samples are too flat if the press cylinder height is too low. Samples that are too flat are difficult to handle or cannot be used for automatic preparation (normal height 15 mm).

Thermoplast and Duroplast black
In electrolytic applications, electrically non-conductive Thermoplast is used in combination with Duroplast black. To begin with, a small amount of Thermoplast is applied on the sample and then the missing amount of mounting material is filled up with black Duroplast. This results in an electrically conductive body with a non-conductive preparation surface.

Epo black, Epo-Max and Duroplast blue/black
Zur Kostenreduzierung können EPO schwarz, EPO-Max und Duroplast blau/schwarz zusammen mit In order to achieve a cost reduction, Epo black, Epo-Max and Duroplast blue/black can be used together with bakelites. The sample is covered with a small amount of the desired mounting material and then filled up with the cheaper bakelites.

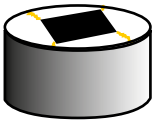
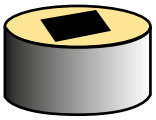
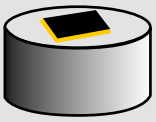
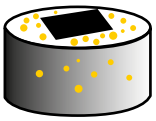
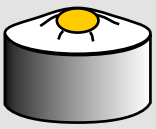
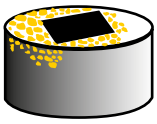
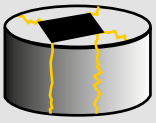
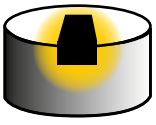
Indicators for too low mounting temperature or pressure during the mounting process are inhomogeneous or milky looking mounting material. The mounting parameters set on the mounting press should superimpose with the optimum of the used mounting material. In principle mounting processes with two differing mounting materials are possible.

	Mounting material	Recommended application
	EPO black	**epoxy resin with high edge retention** » very high hardness » contains a high proportion of glass and mineral filler
	EPO-Max	**epoxy resin with high edge retention** » very high hardness » easy cleaning of mould and ram due to low adhesion » with a proportion of mineral filler
	Duroplast blue	**diallylphtalate with high edge retention** » general purpose, edge examination, hard material, very well suited for grinding stones » high hardness » very low shrinkage » contains a high proportion of glass filler
	Duroplast black	**phenolic resin for SEM examinations and electrolytic polishing** » medium hardness » conductive, contains graphite particles
	Thermoplast	**acrylic resin for transparent mounts** » ideal for target preparations, sensitive samples » low to medium hardness
	Bakelite black	**phenolic resin for general purpose, routine mountings** » medium hardness » contains wood flour
	Bakelite red	**phenolic resin for general purpose, routine mountings** » medium hardness » contains wood flour
	Bakelite green	**phenolic resin for general purpose, routine mountings** » medium hardness » contains wood flour



TROUBLESHOOTING

Solution-oriented procedure

Problem		Cause	Solution
Edge cracks		Sample with sharp edges or sample mounted too close to sample edge.	If possible, round off edges and mount sample with distance of at least 3 mm to the edge.
Bulging		Cooling time too short.	Increase cooling time, check cooling water intake.
Dull surface finish		Heating time too short.	Extend heating time.
Gap between sample and mounting material		Wrong mounting material or sample too large.	Use mounting material with low shrinkage, if possible, cut up sample.
Porosity		Temperature too high (hot mounting material). Proportion of hardener too high (KEM 90).	Lower heating temperature. Check dosage.
Blastering		Cooling time too short or heating temperature too high.	Increase cooling time, check cooling water supply, lower heating temperature.
Individual grains visible on mounting ** Only in case of warm curing mounting materials*		Curing of mounting material without pressure.	Increase pressure during heating, check pressure cylinder.
Inner cracks *(Thermoplast)*		Heating time too short.	Extend heating time, extend cooling time.
"Cottonball effect" in centre of mount *(Thermoplast)*		Heating time too short.	Extend heating time, extend cooling time.

GOOD TO KNOW

Remarks

A longer mounting time can avoid bulging or mountings that are too soft.
Incorrectly melted or milky mounting material means that temperatures and pressure are too low during mounting. The temperature and pressure values set on the mounting press should always correspond to the recommended values for the mounting material used. In general, two-layer mountings are possible.

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ORDERING INFORMATION

APPLIANCES FOR COLD MOUNTING

Ordering Information

Item No.	Unit	Description
		Infiltration set
		» for cold mounting and hardening using vacuum **» recommended for Epoxy resin**
Z6510000	1 Pc.	Desiccator incl. non-return valve, vacuum pump, hose and pressure gauge
		Infiltration unit
		» for cold mounting, pouring and hardening using vacuum
M6500001	1 Pc.	Infiltration unit, 230 V/50 Hz, vacuum pressure 0.8 bar, W330 x H270 x D300 mm
		110 V/60 Hz on request
		Pressure unit
		» for bubble free hardening of methylmethacrylates (e. g. for Technovit 4004, KEM 20), compressed air required
95016569	1 Pc.	Pressure equipment, dimensions: D340 x W340 x H255 mm
		Qmount UV mounting device
		» The Qmount is a modern device for the light curing-based mounting of materialographic samples
M0761000	1 Pc.	Qmount UV mounting device, dimensions: W377 x D436 x H172 mm

APPLIANCES FOR HOT MOUNTING

Ordering Information

Item No.	Unit	Description
		Qpress 50 modular hot mounting press
		» The Qpress 50 is a modular hot mounting press for fast and simultaneously independent mounting of different materialographic specimens.
M0800004	1 Pc.	Qpress 50-2, basic unit extendable with 1 additional pressing unit (total up to 2 pressing units), 200-240 V, 50/60 Hz
M0800002	1 Pc.	Qpress 50-4, basic unit extendable with up to 3 additional pressing units (total up to 4 pressing units), 200-240 V, 50/60 Hz
		Opal 410 and Opal 480 hot mounting presses
		» The OPAL 410 and OPAL 480 are fully hydraulic, water cooled hot mounting presses for mounting samples before polishing.
M0770000	1 Pc.	Opal 410, automatic hot mounting press, bayonet closure, 230 V/50 Hz (1Ph/N/PE)
M0790000	1 Pc.	Opal 480, automatic hot mounting press, fully automatic sliding closure, 230 V/50 Hz (1Ph/N/PE)

ORDERING INFORMATION

COLD MOUNTING MATERIAL

Ordering Information

Item No.	Unit	Description
		Cold mounting material methylmethacrylate
		CT = curing time
		KEM 15 plus, blue, opaque, high edge retention **2-component system: powder + liquid (1.5:1 [Vol.-%])** **» for mounting with high edge retention, edge examination** **» medium-hard to hard materials**
95012019	1 Pc.	KEM 15 plus, SET including 1 kg powder, 500 ml liquid, 40 mixing cups, 40 mixing sticks, 2 dosing spoons
95011628	1 kg	KEM 15 plus, powder, blue, opaque, CT: approx. 20 min
95011630	10 kg	KEM 15 plus, powder, blue, opaque, CT: approx. 20 min
95011629	500 ml	KEM 15 plus, liquid
95011631	5 l	KEM 15 plus, liquid
		KEM 20, transparent (pressure appliance) **2-component system: powder + liquid (2:1 [Vol.-%])** **» for transparent mounting (pressure vessel), target preparation**
95013990	1 Pc.	KEM 20, SET including 1 kg powder, 500 ml liquid, 40 mixing cups, 40 mixing sticks, 2 dosing spoons
95013939	1 kg	KEM 20, powder, transparent, CT: approx. 12 min
95013940	5 kg	KEM 20, powder, transparent, CT: approx. 12 min
95013941	10 kg	KEM 20, powder, transparent, CT: approx. 12 min
95013942	500 ml	KEM 20, liquid
95013943	1 l	KEM 20, liquid
		KEM 30, green, transparent **2-component system: powder + liquid (2:1 [Vol.-%])** **» for semi-transparent mounting (pressure vessel), routine work** **» soft to medium-hard materials**
95012021	1 Pc.	KEM 30, SET including 1 kg powder, 500 ml liquid, 40 mixing cups, 40 mixing sticks, 2 dosing spoons
92004080	1 kg	KEM 30, powder, green, transparent, CT: approx. 5 min
92004082	5 kg	KEM 30, powder, green, transparent, CT: approx. 5 min
92004081	500 ml	KEM 30, liquid
92004083	1 l	KEM 30, liquid
92002540	2.5 l	KEM 30, liquid
		KEM 35, light green, opaque, good edge retention **2-component system: powder + liquid (1.5:1 [Vol.-%])** **» for mounting with good edge retention, edge examination** **» medium-hard to very hard materials**
95012022	1 Pc.	KEM 35, SET including 1 kg powder, 500 ml liquid, 40 mixing cups, 40 mixing sticks, 2 dosing spoons
92002473	1 kg	KEM 35, powder, light green, opaque, CT: approx. 12 min
92002474	5 kg	KEM 35, powder, light green, opaque, CT: approx. 12 min
92002512	10 kg	KEM 35, powder, light green, opaque, CT: approx. 12 min
92002475	500 ml	KEM 35, liquid
92002476	1 l	KEM 35, liquid
92002477	2.5 l	KEM 35, liquid

ORDERING INFORMATION

COLD MOUNTING MATERIAL

Ordering Information

Item No.	Unit	Description
		Cold mounting material MMA-free
		CT = curing time
		KEM 60, red **2-component system (MMA-free): powder + liquid (2:0.9 [weight-%])** **» universal usage**
95014004	1 Pc.	KEM 60, SET including 1 kg powder, 500 ml liquid, 40 mixing cups, 40 mixing sticks, 2 dosing spoons
95013184	1 kg	KEM 60, powder, red, CT approx. 8-10 min.
95013185	5 kg	KEM 60, powder, red, CT approx. 8-10 min.
95013186	10 kg	KEM 60, powder, red, CT approx. 8-10 min.
95013187	500 ml	KEM 60, liquid
		Cold mounting material epoxy resin
		CT = curing time
		KEM 90, clear, transparent **2-components-system: resin + hardener (2:1 [weight-%])** **» suitable for vacuum infiltration e.g. porous materials**
92002484	500 ml	KEM 90, resin, clear, transparent, CT: approx. 16-24 h
92002485	250 ml	KEM 90, hardener
		KEM 92, clear, transparent **2-components-system: resin + hardener (4:1 [weight-%])** **» for vacuum impregnation, brittle, and sensitive material**
95016854	1 l	KEM 92, resin, clear, transparent, CT: approx. 13 h
95016855	250 ml	KEM 92, hardener
		Cold mounting material methacrylate
		CT = curing time
		KEM 50 UV, clear, transparent **1-component system** **» light curing at 365 nm** **» for soft to medium hard materials, standard samples**
95016840	1 l	KEM 50 UV, CT: approx. 1 min.
		Cold mounting material methylmethacrylate
		CT = curing time
		Technovit 4000 SET, white, opaque **3-component system: powder + liquid 1 + liquid 2 (3:2:1 [Vol.-%])** **» with high edge retention, edge examination, medium hard to hard materials**
92001683	1 Pc.	Technovit 4000 SET (750 g / 500 ml / 250 ml), white, opaque, CT: approx. 8 min
92001684	1 Pc.	Technovit 4000 SET (1.5 kg / 1 Ltr. / 500 ml), white, opaque, CT: approx. 8 min
		Technovit 5000, copper-brown **2-component system: powder + liquid (1.55:1 [Vol.-%])** **» conductive, for SEM examinations**
95004058	1 kg	Technovit 5000, powder, copper-brown (bubble-free with pressure vessel), CT: approx. 7 min
95004059	500 ml	Technovit 5000, liquid
		» Download of Safey Data Sheets at www.qatm.com

ORDERING INFORMATION

COLD MOUNTING MOULDS

Ordering Information

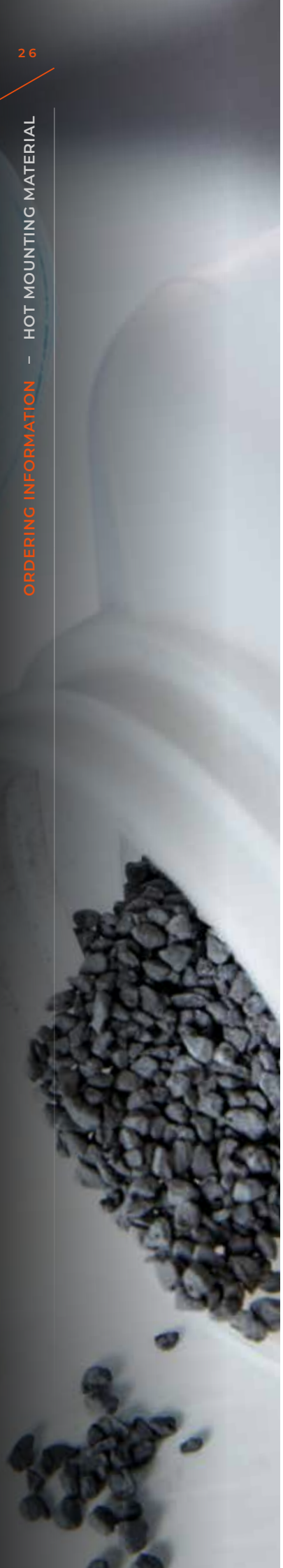
Item No.	Unit	Description
		Cold mounting moulds
		Silicon rubber round, beveled edge **» reuseable** **» not suitable for light curing**
92002511	1 Pc.	Silicon rubber round, Ø 25 mm / H 23 mm
92002504	1 Pc.	Silicon rubber round, Ø 30 mm / H 25 mm
92002505	1 Pc.	Silicon rubber round, Ø 32 mm / H 25 mm
92002506	1 Pc.	Silicon rubber round, Ø 38 mm / H 25 mm
92005567	1 Pc.	Silicon rubber round, Ø 40 mm / H 30 mm
92005568	1 Pc.	Silicon rubber round, Ø 50 mm / H 30 mm
		Silicon rubber square, beveled edge **» reuseable** **» not suitable for light curing**
92002509	1 Pc.	Silicon rubber square, 55 x 30 mm / H 22 mm
92002510	1 Pc.	Silicon rubber square, 70 x 40 mm / H 22 mm
		Polypropylen round **» reuseable** **» for light curing** **» with exchangeable bottom**
92001719	1 Pc.	Polypropylene round, Ø 25 mm / H 27 mm
92001710	1 Pc.	Polypropylene round, Ø 30 mm / H 27 mm
92001711	1 Pc.	Polypropylene round, Ø 40 mm / H 27 mm
		Polyethylene round, **» reuseable** **» with exchangeable bottom**
95016167	1 Pc.	Polyethylene round, Ø 25 mm / H 25 mm
95016168	1 Pc.	Polyethylene round, Ø 30 mm / H 25 mm
95016169	1 Pc.	Polyethylene round, Ø 40 mm / H 25 mm
95011522	1 Pc.	Polyethylene round, Ø 50 mm / H 25 mm
		PTFE round, beveled edge **» reuseable** **» not suitable for light curing** **» with exchangeable bottom**
92002513	1 Pc.	PTFE round, Ø 25 mm / H 23 mm
92002514	1 Pc.	PTFE round, Ø 30 mm / H 25 mm
92002515	1 Pc.	PTFE round, Ø 32 mm / H 25 mm
92002516	1 Pc.	PTFE round, Ø 38 mm / H 25 mm
92002517	1 Pc.	PTFE round, Ø 40 mm / H 30 mm
92002518	1 Pc.	PTFE round, Ø 50 mm / H 30 mm
92002519	1 Pc.	PTFE round, Ø 70 mm / H 30 mm

ORDERING INFORMATION

ACCESSORIES FOR COLD MOUNTING

Ordering Information

Item No.	Unit	Description
		Accessories for cold mounting
92001715	100 Pcs.	Mixing cups, disposable, 180 ml
92004360	1 Pc.	Silicon mixing cup, reusable
92001717	100 Pcs.	Mixing sticks (wood)
92002623	100 Pcs.	Plastic mounting aid Ø 30 mm, gap 1 mm
92002625	100 Pcs.	Plastic mounting aid Ø 30 mm, gap 2 mm
92002624	100 Pcs.	Plastic mounting aid Ø 30 mm, gap 3 mm
95016787	10 Pcs.	Transparent mounting aid, sample thickness <1 mm
95016788	50 Pcs.	Transparent mounting aid, sample thickness <1 mm
95016789	100 Pcs.	Transparent mounting aid, sample thickness <1 mm
95016790	10 Pcs.	Transparent mounting aid, sample thickness 1-2 mm
95016791	50 Pcs.	Transparent mounting aid, sample thickness 1-2 mm
95016792	100 Pcs.	Transparent mounting aid, sample thickness 1-2 mm
95016793	10 Pcs.	Transparent mounting aid, sample thickness 2-3 mm
95016794	50 Pcs.	Transparent mounting aid, sample thickness 2-3 mm
95016795	100 Pcs.	Transparent mounting aid, sample thickness 2-3 mm
95016796	10 Pcs.	Transparent mounting aid, sample thickness 3-4 mm
95016797	50 Pcs.	Transparent mounting aid, sample thickness 3-4 mm
95016798	100 Pcs.	Transparent mounting aid, sample thickness 3-4 mm
92002715	1 Pc.	Square bottle with screw-top for approx. 1 ltr. mounting material
92002657	100 Pcs.	Angle adapter for angled polishing, 10°
92001716	10 Pcs.	Dosing spoon for hot and cold mounting material, 13 ml
92001779	10 Pcs.	Dosing spoon for cold mounting material, 20 ml
92001781	10 Pcs.	Dosing spoon for cold mounting material, 13 ml
92002662	100 Pcs.	Steel clip for for aligning thin samples in mould
92002663	100 Pcs.	Plastic clip for aligning thin samples in mould, transparent
92002707	100 Pcs.	Plastic clip for aligning thin samples in mould, black
92002708	100 Pcs.	Plastic clip for aligning thin samples in mould, red
92002709	100 Pcs.	Plastic clip for aligning thin samples in mould, grey



ORDERING INFORMATION

HOT MOUNTING MATERIAL

Ordering Information

Item No.	Unit	Description
		Hot mounting material
		EPO-Max, black, epoxy resin, high edge retention **» very high hardness** **» easy cleaning of mould and ram due to low adhesion** **» with mineral filler**
95013811	1 kg	EPO-Max black
95013812	5 kg	EPO-Max black
95013813	10 kg	EPO-Max black
		EPO black, epoxy resin, high edge retention **» very high hardness** **» contains a high proportion of glass and mineral filler**
95011990	1 kg	EPO black
95011991	5 kg	EPO black
95011992	10 kg	EPO black
		Duroplast blue, diallylphthalate, high edge retention **» general purpose and especially for grinding stones** **» high hardness** **» contains a high proportion of glass fiber**
95011999	1 kg	Duroplast blue
95012000	5 kg	Duroplast blue
95012001	10 kg	Duroplast blue
		Duroplast black, phenolic resin for SEM examinations and electrolytic polishing **» medium hardness** **» conductive, contains graphite particles**
95011993	1 kg	Duroplast black
95011994	5 kg	Duroplast black
95011995	10 kg	Duroplast black
		Thermoplast, acrylic resin for transparent mounts **» ideal for targeted preparations** **» low to medium hardness**
95011996	1 kg	Thermoplast
95011997	5 kg	Thermoplast
95011998	10 kg	Thermoplast

EXPIRY DATE OF CONSUMABLE

Product designation	Expiry date
Hot mounting	**Years**
Bakelite	2
EPO black, EPO-Max	2
Duroplast	2
Thermoplast	2

Product designation	Expiry date
Cold mounting	**Years**
Methacrylates as e.g. KEM 15 plus, 20, 30, 35, 60	2
Epoxy resin KEM 90	1
Mounting moulds	2
Releasing agent	2
Miscellaneous	**Years**
Ethanol and acetone	2

ORDERING INFORMATION

ACCESSORIES FOR HOT MOUNTING

Ordering Information

Item No.	Unit	Description
		Hot mounting material
		Bakelite black, phenolic resin for general purpose **» medium hardness** **» contains wood powder** **» very convenient material for filling**
95011981	1 kg	Bakelite black
95011982	5 kg	Bakelite black
95011983	10 kg	Bakelite black
		Bakelite red, phenolic resin for general purpose **» medium hardness** **» contains wood powder**
95011984	1 kg	Bakelite red
95011985	5 kg	Bakelite red
95011986	10 kg	Bakelite red
		Bakelite green, phenolic resin for general purpose **» medium hardness** **» contains wood powder**
95011987	1 kg	Bakelite green
95011988	5 kg	Bakelite green
95011989	10 kg	Bakelite green
		Accessories for hot mounting
92002660	90 ml	Silicon paste, anti-stick agent
92002661	200 ml	Silicon spray, anti-stick agent
92004441	1 Pc.	Brass brush for cleaning of hot mounting press
92002658	1 Pc.	Funnel for hot mounting material
92002715	1 Pc.	Square bottle with screw-top for approx. 1 ltr. mounting material
92002657	100 Pcs.	Angle adapter for angled polishing, 10°
92001716	10 Pcs.	Dosing spoon for hot and cold mounting material, 13 ml
92002662	100 Pcs.	Steel clip for for aligning thin samples in mould
92002663	100 Pcs.	Plastic clip for aligning thin samples in mould, transparent
92002707	100 Pcs.	Plastic clip for aligning thin samples in mould, black
92002708	100 Pcs.	Plastic clip for aligning thin samples in mould, red
92002709	100 Pcs.	Plastic clip for aligning thin samples in mould, grey

Remarks

"The indicated expiry dates represent the minimum shelf life of the QATM consumables. Complete functionality of the products is guaranteed inside this period in time. Reaching the expiry date does not cause a loss in the functionality of the products. This means they can be used after the date. Correct storage is essential to ensure full functionality of the products. It has to be ensured that the consumables are not exposed to strong temperature changes and high humidity.
When outside temperatures are very high, delivery of the liquids of KEM 15, 20, 30, 35 and 60 is restricted. For further information please read the data sheet. The consumables and their packaging should not be opened unless for direct use e.g. cut-off wheels are hygroscopic and cold mounting materials can react with oxygen. This might influence the functionality in the long term. Please, in your interest, ensure you have fresh supplies, do not order too much.
The expiry date starts from shipping date.
Complaints are checked by our quality management and application team.
Our general terms and conditions remain unaffected by this."

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