Technical Guide

IPS e.max®
ZirCAD Prime
chairside

Zirconium oxide block
(ZrO_2)

Making People Smile

ivoclar

IPS e.max®

The IPS e.max® brand from Ivoclar comprises various all-ceramic products based on lithium disilicate glass-ceramic (LS_2) and zirconium oxide (ZrO_2). As a result of their versatility, their successful long-term clinical performance and their wide range of indications, they range among the most successful and most used all-ceramic materials in the world.

The highly esthetic and high-strength IPS e.max materials allow all types of fixed prosthetic restorations to be created – from thin veneers to multiple-unit bridges. Hybrid restorations are also possible.

The coordinated shade concept on which the system and the individual products are based ensures user-friendly shade determination and material selection and enables flexible working.
IPS e.max is a comprehensive, high-quality all-ceramic system for all types of restorations, esthetic requirements and patient situations: all ceramic – all you need.

Please observe the regulatory Instructions for Use (www.ivoclar.com/eIFU).

IPS e.max® blocks

IPS e.max® CAD
Lithium disilicate glass-ceramic (LS_2)

For: crowns, bridges[1], inlays, onlays, veneers, partial crowns and implant-supported hybrid restorations

Strength: 530 MPa[2]

IPS e.max® ZirCAD Prime
Zirconium oxide ceramic (ZrO_2)

For: full-contour crowns, bridges (with up to 2 connected pontics)

Strength: 1100 MPa[3]

OptraGloss® Extra Oral
Polisher

IPS e.max® CAD Crystall./Shades/Stains and Glaze
Universal stains and glazes

For: IPS e.max® CAD, IPS e.max® ZirCAD Prime and IPS Empress CAD

IPS e.max CAD is the lithium disilicate glass-ceramic (LS_2) for the CAD/CAM technique. It is a unique material that combines outstanding esthetic properties with high user friendliness. The digitally fabricated restoration is selected from a comprehensive range of applications, which is only offered by IPS e.max CAD. A multitude of translucency levels, shades and block sizes enables flexible working. Proven and coordinated luting materials ideally complement the range of products.

IPS e.max ZirCAD Prime is a zirconium oxide ceramic that permits particularly quick milling and sintering, a characteristic which makes it suitable for single-visit treatments. IPS e.max ZirCAD Prime blocks are suitable for the fabrication of restorations that range from monolithic crowns to 4-unit bridges. The high strength of IPS e.max ZirCAD permits thin wall thicknesses and tooth-structure preserving preparation. Moreover, the restorations can be seated using conventional (e.g. ZirCAD Cement), self-adhesive or adhesive cementation.

IPS e.max CAD Crystall./Shades/Stains and Glaze is a universal system of stains and glazes for IPS e.max CAD, IPS e.max ZirCAD and IPS Empress CAD. The glazing material is available with and without fluorescence effect.

OptraGloss® Extra Oral is a two-stage diamond polishing system for the extraoral polishing of oxide ceramics (e.g. zirconium oxide) and glass-ceramics (e.g. lithium-disilicate ceramic or leucite glass-ceramics). In addition to the three differently shaped polishers, a diamond polishing paste is available.

[1] Only up to the second premolar as the distal abutment
[2] Mean biaxial flexural strength, result after more than 10 years of continuous quality testing, R&D Ivoclar, Schaan.
[3] Dentin, typical mean value of flexural strength, R&D Ivoclar, Schaan.

Table of Contents

Explanation of symbols

Symbol	Note
	Important
	Information
	Contraindication
	Tips and tricks
	Note on firing
	See Instructions for Use

Product information

IPS e.max® ZirCAD Prime

Material

IPS e.max® ZirCAD Prime blocks have been specifically designed for the quick and reliable processing in a suitable CAD/CAM system. The properties of the material have been adjusted to also meet the needs of high-speed milling. The sintering process imparts the material with its final dimensions, final strength and esthetic properties. The raw materials used allow for high-speed sintering, without detrimentally affecting its esthetic properties. Optimal results are achieved when the restorations are sintered in the Programat CS6.
The blocks consists of several layers featuring different raw materials. The dentin area is composed of 3Y-TZP zirconium oxide, which ensures high strength and fracture toughness. 5Y-PSZ, which is used in the incisal area, offers very high translucency. The transitional area made of 4Y-TZP creates a natural shade and translucency progression between the two layers.
Consequently, restorations that meet high mechanical demands can be fabricated, such as 4-unit bridges with two connected pontics. At the same time, esthetically pleasing results are possible even without complex customization.
The restorations can either only be polished (using e.g. OptraGloss® Extra Oral) or glazed with e.g. IPS e.max Crystall./Glaze, which is available with or without fluorescence effect.
For individual characterizations, the universal staining system IPS e.max CAD Crystall./Shades/Stains can be used.
In conjunction with an appropriate preparation, restorations can be conventionally cemented (with e.g. ZirCAD Cement). Self-adhesive (with e.g. Speedcem® Plus) or adhesive cementation (with e.g. Variolink® Esthetic) is also possible.

Types of restorations

- Crowns
- Bridges (max. 2 connected pontics, max. 4-unit bridges)

Technical specifications

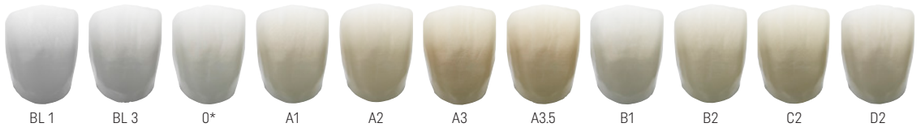
Characteristics	Unit	Specifications	Typical mean value
CTE (25–500 °C)	[$10^{-6} \cdot K^{-1}$]	10.5 ± 0.5	–
Flexural strength (biaxial, dentin)	[MPa]	≥ 900	1100
Fracture toughness (dentin)	[$MPa \cdot m^{1/2}$]	–	5.5 (ISO 6872:2015) 4.4 (based on ISO 14627:2012)

Block concept

IPS e.max ZirCAD Prime blocks are available in two sizes.
- C17: Single-tooth restorations
- B50: Bridges

IPS e.max ZirCAD Prime blocks consist of different layers of raw material (3Y, 4Y and 5Y) to ensure a natural progression of shade and translucency. The upper third of the block exhibits a higher translucency. The two lower thirds feature a higher masking capability and higher strength.

Shades



* Shade "0" is an A1 shade with a lower amount of pigment and a chroma between shade A1 and BL3.

With the polishing technique, the shade effect may differ from that of the shade guide. Depending on the degree of polishing, the shade effect/intensity is increased. It is recommended to select a block shade that is one shade brighter than the target shade.
Detailed information on the available block sizes and shades can be found in the CAD/CAM Block Overview at www.ivoclar.com

Overview of working steps

Working steps	Ivoclar products
Shade determination Preparation	OptraGate®, IPS® Natural Die Material (Die material)
Intraoral imaging CAD/CAM process	OptraGate®, IPS e.max® ZirCAD Prime
Optional: Pretreatment in the presintered stage	OptraGloss® Extra Oral
Sintering	Programat® CS6
High-gloss polishing / Glazing/staining technique	OptraGloss® Extra Oral / IPS e.max® CAD Crystall./ Shade, Stains and Glaze Glaze Spray, Glaze Paste, Glaze Paste FLUO, Glaze Liquid
Preparing for cementation	Ivoclean, Monobond® Plus
Cementation	OptraGate®, OptraDam® ZirCAD® Cement, Speedcem® Plus, Variolink® Esthetic
Checking the articulation/occlusion Intraoral polishing	OptraGloss®
Aftercare	Cervitec® Plus

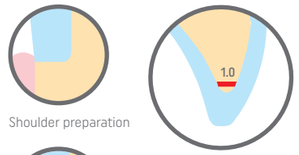
The range of available products may vary from country to country.

Preparation guidelines

Before you begin with the actual reconstruction, please ensure that the preparation is adequate for ceramic restorations. Successful results can only be achieved with IPS e.max ZirCAD if the guidelines and minimum layer thicknesses are strictly observed.

Basic preparation guidelines for all-ceramic restorations

- Prepare no angles or edges
- The ideal preparation is a shoulder preparation with rounded inner edges and/or a chamfer preparation.
- The indicated dimensions reflect the minimum dimensions for IPS e.max ZirCAD Prime restorations.
- The diameter of the edges of the preparation should be at least 1.0 mm (milling tool geometry) in order to permit optimum processing in the milling machine.
- Evenly reduce the anatomical shape while observing the stipulated minimum wall thicknesses.

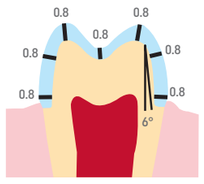
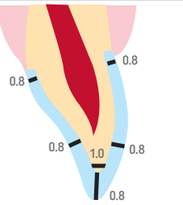
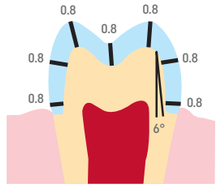
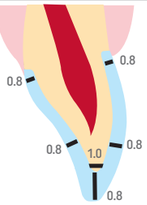


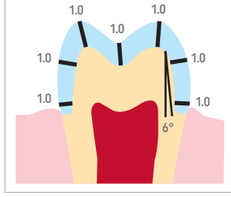
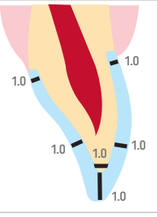
Shoulder preparation

Chamfer preparation

Preparation guidelines for single crowns and 3-unit bridges made of IPS e.max ZirCAD Prime

- The ideal preparation is a shoulder preparation with rounded inner edges and/or a chamfer preparation with a shoulder/chamfer width of 0.8 mm.
- Individual teeth and abutment teeth should be reduced by at least 0.8 mm in the incisal/occlusal area.
- The reduction in the labial/lingual area should be at least 0.8 mm.

Posterior crown	Anterior crown	3-unit bridges	
		Posterior crown as bridge abutment	Anterior crown as bridge abutment
			

4-unit bridges	
Posterior crown as bridge abutment	Anterior crown as bridge abutment
	

Dimensions in mm

Preparation guidelines for 4-unit bridges made of IPS e.max® ZirCAD Prime

- The ideal preparation is a shoulder preparation with rounded inner edges and/or a chamfer preparation with a shoulder/chamfer width of 1.0 mm.
- Individual teeth and abutment teeth should be reduced by at least 1.0 mm in the incisal/occlusal area.
- The reduction in the labial/lingual area should be at least 1.0 mm.

Design criteria

The restoration design is key to the success of durable all-ceramic restorations. The more attention is given to the design, the better the final results and clinical success.

The following minimum layer thicknesses have to be observed to achieve the tooth shade of the shade guide and to fulfil the requirements stipulated in the preparation guidelines. The minimum layer thicknesses refer to the layer thickness of IPS e.max ZirCAD Prime.

Connector dimensions

If possible, the connector dimensions of bridges should be extended in the vertical direction rather than in the horizontal direction. Especially in anterior bridges, it is not always possible to achieve the necessary connector dimensions in the sagittal (lingual-vestibular) direction. In such cases, the connector dimensions must always be extended in the vertical (incisal-cervical) direction.

- Aim for the largest possible dimensions when designing the connectors.
- The height of the connector is more important for the stability than the width. Doubling the width only results in double the stability, while doubling the height can result in up to eight times the stability.
- The greater the distance between the abutment teeth and the greater the exerted masticatory forces, the higher the mechanical stress on the construction will be.

Wall thicknesses/connector dimensions of the sintered restoration

	Posterior region		Anterior region		Design type
	Minimum wall thickness in mm	Connector dimensions in mm	Minimum wall thickness in mm	Connector dimensions in mm	
Crowns	0.8	–	0.8	–	Supporting the tooth shape and/or the gingiva (incisal, occlusal and/or basal)
3-unit bridges	0.8	9[a]	0.8	9[a]	
4-unit bridges	1.0	12[a,b]	1.0	9[a]	

[a] The indicated minimum connector dimensions must be positioned in the dentin area of the block.
[b] height: 4 mm, width: 3 mm

Failure to observe the stipulated minimum wall thicknesses and connector dimensions may result in clinical failures, such as cracks, delamination, and fracture of the restoration.

Overview of processing techniques

Fabrication process

CAD/CAM processing

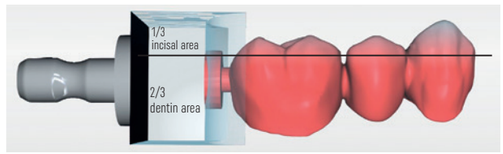
Since IPS e.max ZirCAD Prime shrinks by approximately 20–25% during sintering, the shrinkage factor of the respective batch, which is included in the code on the material block, must be read into the software or manually entered. The shrinkage factor then ensures that the CAM processed IPS e.max ZirCAD Prime restorations demonstrate an optimum accuracy of fit after sintering.

For dry processing, make sure that the chamber of the milling machine has been cleaned beforehand and that the chamber is dry.

For the wet processing of IPS e.max ZirCAD Prime, a dedicated milling fluid container should be used to avoid cross-contamination with other materials (e.g. milling dust). Do not exceed the maximum amount of recommended milling fluid for wet processing. Contamination may result in discolouration of the restorations during sintering.

Choose a dry processing procedure if possible. This will eliminate the predrying step before sintering and thus saves you time.

Positioning of the IPS e.max® ZirCAD Prime restoration (CAD software)



To ensure that restorations made of IPS e.max ZirCAD Prime show a clearly visible enamel area, they must be positioned as high up as possible on the block in the CAM software. For single-tooth restorations, it is recommended to place the restoration approximately 1 mm below the top edge of the block to obtain a clearly visible incisal portion. Positioning of the restoration in the block is easy as the incisal area is shown in white and the dentin area is shown in red. Bridge restorations must be placed in such a way that the minimum connector dimensions are positioned in the high-strength dentin area.

Marking recess in the block: The dentin area is marked by a recess in the block. The incisal area is located on the opposite side.

CAD/CAM partners

IPS e.max ZirCAD Prime must be processed with an authorized CAD/CAM system. For questions regarding the different CAD/CAM systems, please contact the respective cooperation partners.

The complete list of compatible CAD/CAM systems is available at www.ivoclar.com.

Finishing after the milling process

When separating the restorations from the block, make sure they are not contaminated with any grease or smudgy film since this may negatively influence the shade result.

Please observe the recommendations regarding polishing and grinding instruments on page 40.

General information

- Non-dense-sintered zirconium oxide restorations are susceptible to damage and fractures. This fact has to be kept in mind during the entire working procedure.
- Any necessary post-processing procedures should be carried out while the restoration is still in its non-dense-sintered state.
- In the non-dense-sintered state, the contact with unsuitable liquids or liquids not approved for zirconium oxide (e.g. contaminated water and/or coolant liquid) and/or contact media (e.g. occlusal spray) must be prevented.
- Only use suitable grinding instruments, low speed and light pressure to prevent delamination and chipping at the margins in particular.
- The non-dense-sintered restoration must not be cleaned in an ultrasonic bath or with the steam jet.

Dry-milled restorations

- Carefully separate the restoration from the holder using a separating disc or suitable grinding instruments. Smooth out the attachment points of the holding bars with suitable grinding instruments.
- After finishing, thoroughly remove any adhering zirconium oxide dust either with a soft brush or by blasting the restoration with oil-free compressed air.

Wet-milled restorations

- Carefully separate the restoration from the holder using a separating disc or suitable grinding instruments. Smooth out the attachment points of the holding bars with suitable grinding instruments.
- After finishing, thoroughly remove any adhering zirconium oxide dust from the restoration. Wet-milled restorations may be rinsed with slowly running water.
- In order to prevent damage to the restoration during sintering, the IPS e.max ZirCAD Prime restoration must be completely dry. Moist restorations must not be sintered.

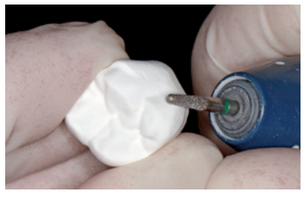
The sintering furnaces Programat CS6, Programat CS4 and CEREC® SpeedFire enable the operator to determine prior to starting the program whether a predrying step is to be carried out or not. Predrying is only required for wet-milled restorations. In general, dry-milling should be preferred.

Notes on finishing

Finishing of sintered restorations should be kept to a minimum.

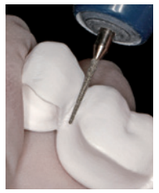
- Coarse tungsten carbide burs and/or coarse grinding instruments are only suitable to a certain extent, since they may cause vibrations during finishing, which may result in chipping, among other things. Therefore, only fine, cross-cut tungsten carbide burs and/or fine grinding instruments should be used.
- Make sure that the minimum wall thicknesses and connector dimensions are maintained during finishing. Do not "post-separate" the connector area of bridge constructions using a separating disc as this leads to predetermined breaking points.
- Dry restorations can already be pretreated with suitable polishers prior to sintering to remove, for example, artifacts left by the milling tools. Please observe the notes in section "Polishing technique".
- Make sure to remove any adhering zirconium oxide dust before sintering. Adhering zirconium oxide particles may be sintered to the restoration and result in inaccuracies of fit.
- The restoration must not be blasted with Al_2O_3 and/or glass polishing beads.

Separate the restoration



Smooth out the attachment points

Smooth out the attachment points



Design/contour the connector

Individualize the fissures

Finished restoration ready for sintering

Sintering

Sintering is one of the most important processes during the fabrication of zirconium oxide restorations. During this process, the porous white body is turned into a densely sintered restoration by the effect of high temperatures. Only this fabrication step creates the final properties, such as the high strength and light transmission. To achieve optimum mechanical and optical properties, it is absolutely mandatory that the defined sintering temperatures and sintering times are observed at all times. Sintering temperatures that are too low or too high and/or sintering times that are too short or too long will have a negative effect on the above mentioned final properties.
The sintering programs of the Programat CS6, Programat CS4 and CEREC® SpeedFire are especially coordinated with restorations made of IPS e.max ZirCAD Prime blocks. They allow optimum optical and mechanical properties to be achieved.

The following notes should be taken into consideration when sintering:

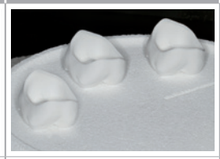
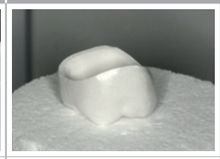
- Sintering temperatures that are too low or too high and/or sintering times that are too short or too long will have a negative effect on the above mentioned final properties.
- Basically, sintering beads are not recommended for the Programat CS6 sintering furnace.
- The restorations must not come into contact with each other during sintering.
- The correct program selection must be observed.
- Always keep the sintering accessories clean and free of dust so that the sintered restorations are not contaminated.
- For correct placement of the restorations in the sintering furnace, please observe the notes of the furnace being used.
- Bridge constructions should not be exclusively supported by the final abutment crowns. Preferably support the restoration in the area of the pontics. The abutment crowns do not absolutely have to come into contact with the sinter tray.
- The respective Operating Instructions of the sintering furnace in use must be observed.

Due to the short sintering cycle, precise temperature calibration is indispensable. Miscalibrations adversely affect the final result. Failure to achieve the desired shade and translucency may be attributed to an inadequately low final temperature, which may stem from incorrect calibration.

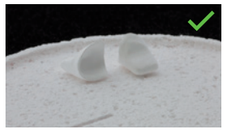
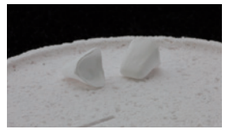
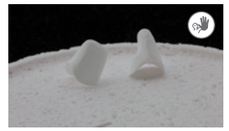
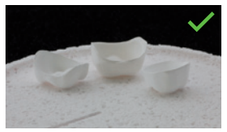
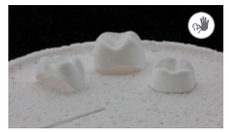
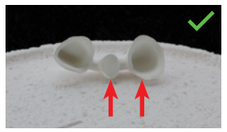
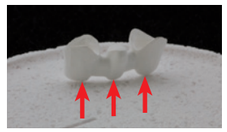
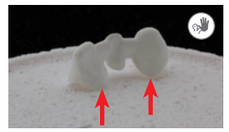
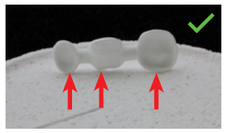
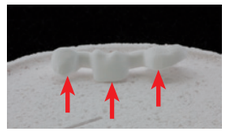
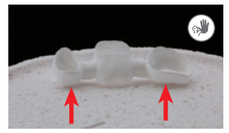
Additional notes on the sintering process in the Programat CS6

- IPS e.max ZirCAD Prime is supported as of software version 2.1.
- Please refer to the Programat CS6 program table available at www.ivoclar.com to find out which programs can be used for sintering IPS e.max ZirCAD Prime blocks.

For the maximum number of restorations that can be sintered in one sintering cycle and the available sintering programs, please see the table below.

Programat® CS6		Programat® CS4	CEREC® SpeedFire	
				
Max. 3 crowns	1 bridge	Max. 3 crowns or one bridge	Max. 2 crowns	1 large crown or one bridge
Superspeed sintering 15:00 min (without predrying, without cooling)	Sintering 23:00 min (without predrying, without cooling)	Speed sintering 27:00 min (without predrying, without cooling)	if the material thickness is <5 mm 16:00 min (without predrying, without cooling)	Default 31:00 min (without predrying, without cooling)
Sintering programs for IPS e.max ZirCAD Prime blocks as of software version V2.1 included		Sintering programs for IPS e.max ZirCAD Prime blocks as of software version V2.1 included		

Please observe the following notes when positioning the restorations on the sinter tray:

	correct ✓	ok	wrong ✋
Single-tooth restorations anterior region	 Place the restorations on their labial surface.	 Place the restorations on their oral surface.	 Do not place the restorations on the crown margins.
Single-tooth restorations posterior region	 Place the restorations on their occlusal surface.		 Do not place the restorations on the crown margins
Multiple-unit anterior restorations ↑ ↑ ↑	 Place the restorations on their labial surface and provide support to the pontic. If the restoration "tilts", select an alternative position.	 Position the restorations on the incisal edges. The pontic must also rest on the sinter tray.	 Do not support the restorations exclusively at the marginal edges.
Multiple-unit posterior restorations	 Place the restorations on their buccal or oral surfaces, depending on the curvature. Abutment crowns do not necessarily need contact to the sinter tray. The pontic must be supported.	 Do not support the restoration exclusively at the crown margins. The pontic must be supported on the basal side.	 If the pontic does not support the restoration, the restoration must not be positioned on the occlusal surface.

↑ Points of contact of the restoration with the sinter tray.

Always allow the hot restorations to cool to room temperature before further processing them.
– Do not touch the hot objects with metal tongs.
– Do not blast or quench the objects.

Use the following procedure for further processing densely sintered, cooled restorations:

- Finishing of sintered restorations should be kept to a minimum.
- The restoration should only be mechanically finished if it is absolutely necessary.
- Check marginal areas and slightly finish, if necessary.
- Use only low pressure for finishing.
- When finishing the restorations, avoid designing sharp edges, aim for rounded ones.
- Do not use a separating disc to separate interdental areas.
- Make sure the minimum wall thicknesses are maintained during finishing.
- Use only immaculate grinding instruments.
- Check the restoration for defects and tears before and after finishing.
- Zirconium oxide dust sintered to the restoration must be removed before polishing and glazing.
- Then clean the restoration with running water or the steam jet and dry.

Polishing technique

Due to the natural shade and translucency progression, it may be sufficient to finalize the restoration only by polishing. Polishing can be done with e.g. OptraGloss® Extra Oral. Further refining by glazing and staining is, of course, possible.

If a restoration is only finalized by means of polishing, at least the occlusal contact surfaces need to be polished to a high gloss. Well-polished surfaces particularly in the occlusal region help to protect the opposing teeth from undesired wear. Additionally smooth the basal side of the framework connectors in bridges using rubber polishers. This has a positive effect on the mechanical properties of the restoration. We recommend polishing all areas of the outer surface to minimize plaque accumulation and to achieve an esthetically pleasing result.

With the polishing technique, the shade effect may differ from that of the shade guide. Depending on the degree of polishing, the shade effect/intensity is increased. If necessary, it is recommended to select a block shade that is one shade brighter than the target shade.

If functional adjustments by grinding in the oral cavity are necessary, make sure that the ground occlusal surfaces are carefully polished and that the original condition is restored. We recommend using OptraGloss® for intraoral polishing. Please observe the recommendations regarding grinding instruments on page 40.

Application of OptraGloss® Extra Oral

When using OptraGloss® Extra Oral, there are basically two options for performing the polishing. Strictly adhering to the instructions is decisive for a satisfactory result.

Before sintering

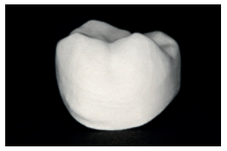
Pretreatment (optional)

Only for dry-milled restorations
Use only light pressure and do not exceed the specified speeds.

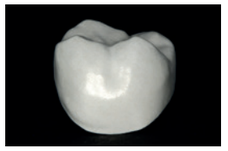
A first pre-polishing is possible even before sintering to ease the effort of polishing for users. This procedure is used to smooth any milling-related marks on the surface. Utmost care must be taken during the process, as the material is still very soft and too much material could be removed inadvertently.

Immediately after separating the restoration from the block and smoothing out the attachment point, smooth the entire outer surface of the restoration. For this purpose, only OptraGloss Extra Oral polishers (spiral wheel shape) should be used. When doing so, use low pressure and a speed of max. 5000 rpm (dark blue) and 10,000 rpm (light blue). Pre-polishing for too long may have an adverse effect on the final polishing outcome. Blue marks from the polishers should be avoided if possible.

As the surface will change again during sintering, all surfaces should be polished again after sintering to keep plaque accumulation as low as possible and achieve a higher gloss. In order to minimize the wear of antagonists, the functional areas in particular must be polished to a high gloss after sintering.


Milled molar crown with visible milling paths


Smoothing the surface with Spiral Wheel PP and Spiral Wheel HP


Unsintered molar crown after pre-polishing


Crown immediately after sintering

Finishing after sintering

Pre-polishing

In the first polishing step after sintering, at least the contact surfaces have to be pre-polished using the OptraGloss® Extra Oral pre-polishers (PP, dark blue). The optimum rotational speed is between 10,000 and 15,000 rpm. Make sure to use the polishers at low pressure to keep their wear as low as possible,

High-gloss polishing

In the second polishing step, the OptraGloss® Extra Oral high-gloss polishers (HP, light blue) are used to polish the restoration to a high lustre. Also in this case, the optimum rotational speed is between 10,000 and 15,000 rpm. Make sure to use the polishers at low pressure.

Optionally, OptraGloss® Extra Oral Polishing Paste can be subsequently applied using a goat hair brush to achieve a particularly high lustre.

If you want to apply a glaze, the surface should not be polished too heavily. OptraGloss® Extra Oral Polishing Paste must not be used in that case.

Crown immediately after sintering

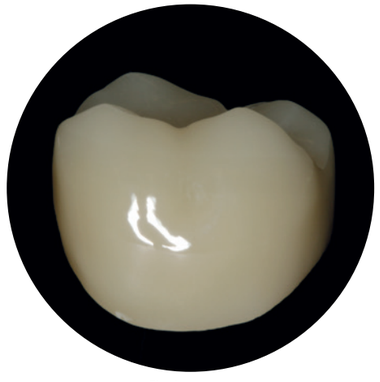
Pre-polishing with OptraGloss Extra Oral PP pre-polishers

Pre-polished crown

High-gloss polishing with OptraGloss Extra Oral HP high-gloss polishers

Crown polished to a high lustre

Optional application of OptraGloss Extra Oral Polishing Paste using a goat hair brush



Final crown

Application parameters at a glance

Pretreatment (optional)	Only Spiral Wheel PP, dark blue (5000 rpm), at low pressure Only Spiral Wheel HP, light blue (10,000 rpm), at low pressure
Sintering	
Pre-polishing	All PP polishers (10,000 – 15,000 rpm), at low pressure
High-gloss polishing	All HP polishers (10,000 – 15,000 rpm), at low pressure

Glazing technique

Required materials

1. IPS e.max CAD Crystall./Glaze Paste Fluo is a ready-to-use fluorescing glazing paste.
2. IPS e.max CAD Crystall./Glaze Paste is a ready-to-use glazing paste.
3. IPS e.max CAD Crystall./Glaze Spray is a ready-to-use glazing spray.
4. IPS e.max CAD Crystall./Glaze Liquid is a special liquid for mixing with Shades, Stains and Glaze.
5. IPS SpeedTray is a silicon nitride firing tray for IPS e.max CAD, IPS e.max ZirCAD and IPS Empress CAD restorations.
6. IPS e.max CAD Crystallization Pins are pins in different sizes.
7. IPS Object Fix Flow and IPS Object Fix Putty are auxiliary firing pastes with different viscosities to stabilize and secure all-ceramic restorations during firing and crystallization.

Preparation

Prior to applying the glaze, the entire outer surface must be smoothed and at least the contact surfaces must be polished to a high lustre. Proceed as described in section 'Polishing technique' on page 17. At least the areas of functional occlusion must have been polished to a high lustre (with e.g. OptraGloss® Extra Oral, HP, light blue). Areas to be glazed should not have been pretreated with polishing paste. In order to apply the glaze paste or spray glaze, hold the restoration in such a way that you can easily access all outer surfaces that need to be coated. The glaze paste or spray glaze must not come in contact with the inner surface of the restoration.

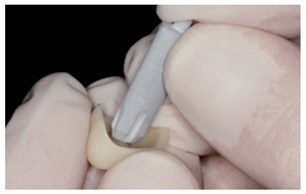
Either IPS Object Fix Putty or Flow are used to secure the restoration on the Crystallization Pin. This avoids a contamination of the inner surfaces and ensures that the restoration can be held securely. The putty demonstrates a denser consistency and thus a higher stability. Given its lower viscosity, Flow is suitable for smaller restorations.

The following procedure has to be observed for crowns and bridges:

- Select the largest possible IPS e.max CAD Crystallization Pin (S, M, L) that best "fills" the inside of the restoration, but does not come into contact with the surrounding crown walls.
- Fill the inside of the restoration with IPS Object Fix Putty or Flow up to the restoration margin. Immediately re-seal the IPS Object Fix Putty/Flow syringe after extruding the material. Once removed from the aluminium bag, the syringe is ideally stored in a resealable plastic bag or a container with a humid atmosphere.
- Press the selected IPS e.max CAD Crystallization Pin deeply into the IPS Object Fix Putty or Flow material so that it is adequately secured.
- Smooth out displaced auxiliary firing paste using a plastic spatula, so that the pin is securely in place and the restoration margins are optimally supported.
- Avoid contamination of the outer restoration surface.
- Clean off any possible contamination with a brush dampened with water and dry.

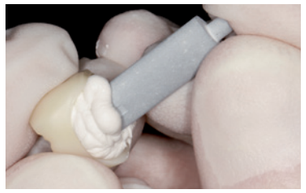
Crown

IPS Object Fix Flow and IPS Object Fix Putty

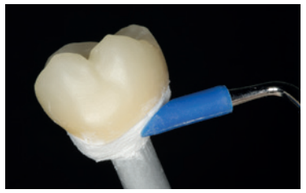


Select the largest possible IPS e.max CAD Crystallization Pin.

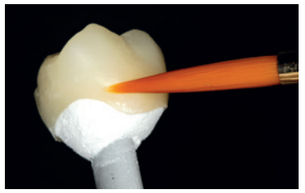
Fill the inside of the crown with IPS Object Fix Putty or Flow.



Press the IPS e.max CAD Crystallization Pin deeply into the IPS Object Fix Putty or Flow material.

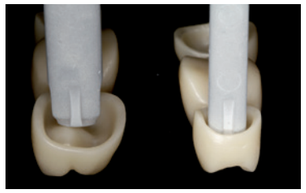


Smooth out displaced IPS Object Fix Putty or Flow using a plastic spatula so that the pin is securely in place and the restoration margins are optimally supported.



Clean off any possible contamination of the outer restoration surface with a brush dampened with water and then dry.

Bridge



Select the largest possible IPS e.max CAD Crystallization Pin.

Fill the inner aspects of the crowns of the cleaned bridge with IPS Object Fix Putty or Flow and press the suitable IPS e.max CAD Crystallization Pin into them.

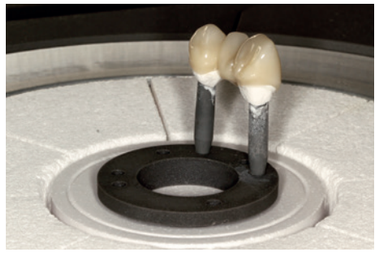
Immediately place the bridge on the IPS Speed Tray.

Smooth out displaced IPS Object Fix Putty or Flow with a plastic spatula from the margin towards the support pins so that the pins are secured in the paste and the crown margins are optimally supported.

Clean off any possible residue adhering to the outer surface of the bridge with a brush dampened with water and then dry.

The following steps must be observed when applying the glaze:

- Apply the glazing material in an even layer on the entire restoration.
- If the ready-to-use glaze needs to be slightly diluted, it may be mixed with a small amount of IPS e.max CAD Crystall./Glaze Liquid.
- Avoid applying too thick a glaze layer. Avoid "pooling", especially on the occlusal surface.
- Too thin a glaze layer may lead to an unsatisfactory gloss.
- If IPS e.max CAD Crystall./Glaze accidentally reaches the inner aspects of the restoration, remove it with a dry short-hair brush before firing.
- Conduct the Glaze firing with the stipulated firing parameters using the firing equipment suitable for the respective ceramic furnace.
- A maximum of 3 units or a bridge can be positioned on the firing tray and fired in the Glaze firing with IPS e.max CAD Crystall./Glaze Paste. The firing parameters are listed in section "Sintering and firing programs".



Conduct the glaze firing in e.g. the Programat CS6. Position the IPS Speed Tray directly on the sinter tray.

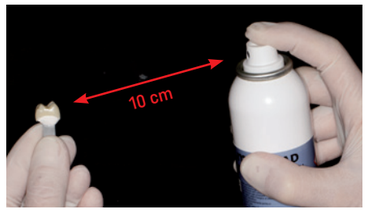
- After the firing process has been completed, remove the restoration from the furnace. Allow the objects to cool to room temperature in a place protected from draft.
- Hot objects must not be touched with metal tongs.

The following steps must be observed when applying the spray glaze to the crown:

- Hold the restoration by the IPS e.max CAD Crystallization Pin. Do not spray the restoration while it is placed on the IPS Speed Tray, as it would then also be coated with glaze.
- Shake the Glaze Spray vigorously immediately before use until the mixing ball in the container is moving freely (approximately 20 seconds). If the spray is not sufficiently shaken, mainly the propellant is discharged during spraying. As a result, the restoration is insufficiently coated with glazing powder.
- Observe a distance of approx. 10 cm between the nozzle and the surface to be sprayed.
- Hold the spray can as upright as possible during spraying.
- Spray the restoration from all sides with short bursts while simultaneously rotating the restoration so that an even layer is created. Shake the can again between individual bursts.
- Spray the restoration a second time from all sides with short bursts while simultaneously rotating the restoration so that an even, covering layer is created. Shake the can again between individual bursts.
- Wait briefly until the glaze layer is dry and has assumed a whitish colour.
- Areas that do not show an even layer have to be sprayed again.
- Place the restoration in the centre of the IPS Speed Tray and fire.

Firing parameters see page 38.

Shake glaze spray vigorously immediately before use.



Hold the restoration by the IPS e.max CAD Crystallization Pin when applying the spray glaze.

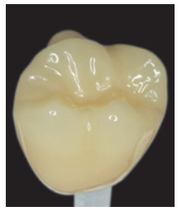
Spray the IPS e.max CAD Crystall./Glaze Spray directly onto the IPS e.max ZirCAD Prime restoration. Spray the restoration from all sides while simultaneously rotating it.

Shake the can again between individual spray bursts.

Spray an even layer onto the restoration.

Allow the IPS e.max CAD Crystall./Glaze Spray to dry briefly until a whitish layer has formed. Spray again, if necessary, to achieve a smooth, even layer on the restoration.

Place the restoration in the centre of the IPS Speed Tray and fire.



Smooth glaze surface after application and drying. This will result in an even gloss after firing.

Example of incorrect Glaze Spray application

Problem/Cause	Before firing Application of the Glaze Spray	After firing Detailed view of the surface
Problem: Not enough Glaze Spray applied on the restoration Possible cause: – Distance between the spray can and the restoration too big – Spraying too short – Spray can was not shaken sufficiently – Spray can not held upright during spraying	 Insufficient application of IPS e.max CAD Crystall./Glaze Spray.	 Insufficient gloss and incomplete glaze layer.
Problem: Too much Glaze Spray applied on the restoration Possible cause: – Distance between the spray can and the restoration too small during spraying – Too much Glaze Spray applied	 Too much IPS e.max CAD Crystall./ Glaze Spray was applied.	 Loss of texture and excessively glossy surface.
Problem: Uneven surface of the restoration Possible cause: – Distance between the spray can and the restoration too big – Spray can was not shaken sufficiently – Spraying too dry (liquid needs to dry slowly on the restoration) – Can almost empty or nozzle obstructed – Can held at the wrong angle to the restoration (too upright or with the nozzle upside down) – Restoration not held in the centre of the spray jet – Insufficient application	 Uneven, "pimply" surface after incorrect application of IPS e.max CAD Crystall./Glaze Spray.	 Rough spray particles on the surface result in a dull and rough surface after firing.

Cleaning the restoration after incorrect application before firing

- Remove the dried spray from the surface using a soft brush until no white powder remains visible (applied Shades and Stains might also be removed).
- Then carefully blast the restoration with compressed air.
- Spray the restoration again (if desired, apply Shades and Stains prior to spraying).

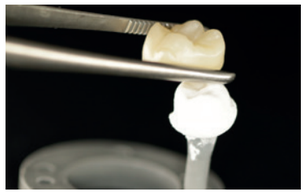
Optional:

- If additional characterizations or adjustments are required after crystallization, a corrective firing using IPS e.max CAD Crystall./Shades/Stains and Glaze/Fluo can be conducted. Also use the IPS e.max CAD Speed Tray for the corrective firing.
- Use the IPS e.max CAD Crystall./Add-On to carry out minor shape adjustments (e.g. proximal contact points). Adjustments can be made using the corrective firing (does not apply to the Programat CS4, CEREC® SpeedFire).
- The detailed procedure is described on page 31.

- Remove the ceramic objects from the furnace after completion of the firing cycle (wait for the acoustic signal of the furnace).
- Allow the objects to cool to room temperature in a place protected from draft.
- Do not touch the hot objects with metal tongs.
- Remove the cool restoration from the set IPS Object Fix Putty or Flow.
- Remove any adhering residue with ultrasound in a water bath and/or with the steam jet.
- If the restoration needs to be adjusted by grinding, make sure that no overheating of the ceramic occurs.

Conduct the Add-On firing under vacuum on an IPS Speed Tray using the stipulated firing parameters.

Firing parameters see page 38.



Remove the cool restoration from the set IPS Object Fix Putty or Flow.

Remove adhering residue with ultrasound in a water bath....

... or with the steam jet.

Completed IPS e.max ZirCAD Prime restoration after Glaze firing.

Staining technique

Required materials

1. IPS e.max CAD Crystall./Glaze Paste Fluo is a ready-to-use fluorescing glazing paste.
2. IPS e.max CAD Crystall./Glaze Paste is a ready-to-use glazing paste.
3. IPS e.max CAD Crystall./Glaze Liquid is a special liquid for mixing with Shades, Stains and Glaze.
4. IPS e.max CAD Crystall./Shades are ready-to-use "Dentin" shades in syringes.
5. IPS e.max CAD Crystall./Stains are ready-to-use intensive stains in syringes.
6. IPS Speed Tray is a silicon nitride firing tray for IPS e.max CAD, IPS e.max ZirCAD and IPS Empress CAD restorations.
7. IPS e.max CAD Crystallization Pins are pins in different sizes.
8. IPS Object Fix Flow and IPS Object Fix Putty are auxiliary firing pastes with different viscosities to stabilize and secure all-ceramic restorations during firing and crystallization.

Before applying the stains, all outer surfaces of the restoration must be polished. Please proceed as described in section “Polishing technique”.
At least the areas of functional occlusion must have been polished to a high lustre (with e.g. OptraGloss® Extra Oral, HP, light blue). Areas to be glazed should not have been polished with polishing paste beforehand.
With this procedure, Stain and Glaze firing is conducted in one step. Characterizations are applied using IPS e.max CAD Crystall./Shades and Stains.

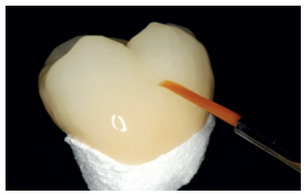
In order to apply the glaze material and stains, hold the restoration in such a way that you can easily access all outer surfaces that need to be coated. However, they must not come in contact with the inner surface of the crown. There are two options:

- Either hold the restoration with a pair of tweezers to apply the material and then place it on a Crystallization Pin for firing.
- Or use IPS Object Fix Putty or Flow to secure the restoration on the Crystallization Pin. This avoids a contamination of the inner surfaces and ensures that the restoration can be held securely. The putty demonstrates a denser consistency and thus a higher stability. Given its lower viscosity, Flow is suitable for smaller restorations.

The following procedure has to be observed for crowns and bridges:

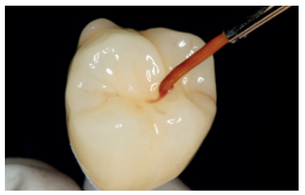
- Hold the restoration by the Crystallization Pin and apply IPS e.max CAD Crystall./Glaze Paste evenly onto the entire restoration using a brush.
- If the ready-to-use glaze needs to be slightly diluted, it may be mixed with a small amount of IPS e.max CAD Crystall./Glaze Liquid.
- Avoid applying too thick a glaze layer. Avoid "pooling", especially on the occlusal surface.
- Too thin a glaze layer may lead to an unsatisfactory gloss.
- If characterizations are desired, the restoration can be individualized using IPS e.max CAD Crystall./Shades and/or IPS e.max CAD Crystall./Stains.
- Extrude the shades and stains from the syringe and mix them thoroughly.
- The shades and stains may be slightly thinned using IPS e.max CAD Crystall./Glaze Liquid. However, the consistency should still remain pasty.
- Apply the mixed shades and stains directly to the unfired glaze layer using a fine brush.

Crown



IPS Object Fix Flow and IPS Object Fix Putty

Extrude IPS e.max CAD Crystall./Shades and Stains from the syringe and mix them thoroughly. Dilute with IPS e.max CAD Crystall./Glaze Liquid if required.



Apply mixed IPS e.max CAD Crystall./Shades and Stains directly into the unfired glaze layer using a fine brush.

Bridge

Apply mixed IPS e.max CAD Crystall./Shades and Stains into the unfired glaze layer using a fine brush.

Characterization guide

With the IPS e.max CAD Crystall./Shades and IPS e.max CAD Crystall./Stains, it is possible to apply characterizations. The following Shades and Stains are available for characterization:

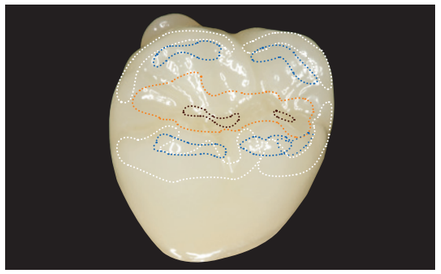
IPS e.max CAD Crystall./Shades							IPS e.max CAD Crystall./Stains						
Shade Incisal 1	Shade Incisal 2	Shade 0	Shade 1	Shade 2	Shade 3	Shade 4	white	cream	sunset	copper	olive	khaki	mahogany

The table below provides an overview of the shades that can be ideally combined:

A–D shade	BL1	BL2	BL3	BL4	0	A1	A2	A3	A3.5	A4	B1	B2	B3	B4	C1	C2	C3	C4	D2	D3	D4
IPS e.max CAD Crystall./Shade					0			1				2				3				4	
IPS e.max CAD Crystall./Shade Incisal				I1					I2			I1					I2				
IPS e.max CAD Crystall./Stains				white			cream		sunset		copper		olive		khaki		mahogany				

Depending on the individual patient situation, the characterizations may be applied as follows (example: shade A2):

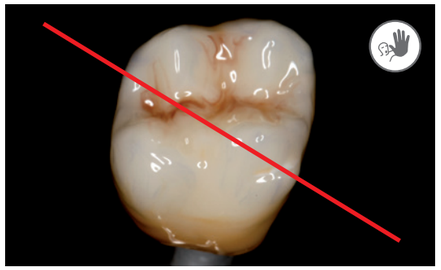
Minor characterizations on the buccal surface using IPS e.max CAD Crystall./Shade Incisal and Stains.



Occlusal characterizations with IPS e.max CAD Crystall./Shades and Stains.

- Cusp slopes: Shade Incisal I1
- Fissures: Stains mahogany
- Cusps, marginal ridges: Stains white/creme
- Enhancing the chroma: Stains sunset/copper

Example of IPS e.max CAD Crystall./Shades and Stains applied too thickly:



After glazing and staining, the Stains/Glaze firing is conducted in a compatible ceramic furnace (e.g. Programat CS6). When placing the objects into the furnace and setting the firing parameters, observe the following points:
- Place the restoration on the IPS Speed Tray.
- A maximum of 3 units or one bridge can be positioned on the firing tray for the Stains and Glaze firing with IPS e.max CAD Crystall./Glaze Paste.

Position the restoration on the IPS Speed Tray and fire using the stipulated firing parameters. Place it on the sinter tray in Programat CS6.

Conduct the Stains and Glaze firing on an IPS Speed Tray using the stipulated firing parameters.

Firing parameters see page 38.

Optional:
- If additional characterizations or adjustments are required after glaze firing, a corrective firing using IPS e.max CAD Crystall./Shades/Stains and Glaze/Fluo can be conducted. Also use the IPS e.max CAD Speed Tray for the corrective firing.
- Use the IPS e.max CAD Crystall./Add-On to carry out minor shape adjustments (e.g. proximal contact points). Adjustments can be made using the corrective firing (does not apply to the Programat CS4, CEREC® SpeedFire).
- The detailed procedure is described on page 31.

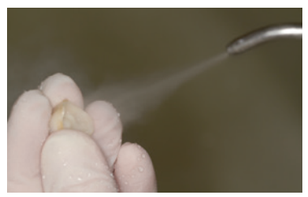
- Remove the ceramic objects from the furnace after completion of the firing cycle.
- Allow the objects to cool to room temperature in a place protected from draft.
- Do not touch the hot objects with metal tongs.
- Remove the cool restoration from the set IPS Object Fix Putty or Flow.
- Remove any adhering residue with ultrasound in a water bath or with the steam jet.
- If the restoration needs to be adjusted by grinding, make sure that no overheating of the ceramic occurs.

Conduct the Add-On firing under vacuum on an IPS Speed Tray using the stipulated firing parameters.

Firing parameters see page 38.

Remove the cool restoration from the set IPS Object Fix Putty or Flow.

Remove adhering residue with ultrasound in a water bath....

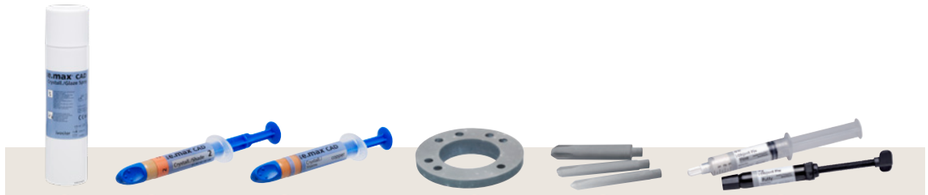


... or with the steam jet.

Observe the following procedure for the crown staining technique with spray application:

In this processing technique, the IPS e.max CAD Crystall./Glaze Spray is used instead of the IPS e.max CAD Crystall./Glaze Paste. Stains/Glaze firing is conducted in one step. Characterizations are applied using IPS e.max CAD Crystall./Shades and Stains. The spray should only be used if IPS Object Fix auxiliary firing paste is adapted up to the margins.

Required materials
1. IPS e.max CAD Crystall./Glaze Spray is a ready-to-use glazing spray.
2. IPS e.max CAD Crystall./Shades are ready-to-use "Dentin" shades in syringes.
3. IPS e.max CAD Crystall./Stains are ready-to-use intensive stains in syringes.
4. IPS Speed Tray is a silicon nitride firing tray for IPS e.max CAD, IPS e.max ZirCAD and IPS Empress CAD restorations.
5. IPS e.max CAD Crystallization Pins are pins in different sizes.
6. IPS Object Fix Flow and IPS Object Fix Putty are auxiliary firing pastes with different viscosities to stabilize and secure all-ceramic restorations during firing and crystallization.



Please observe the following procedure for crowns:
- **Preparation**
  If IPS e.max CAD Crystall./Glaze Spray is used, all the restorations, irrespective of their geometry, have to be placed on an IPS e.max CAD Crystallization Pin with the help of IPS Object Fix Putty or Flow.
- **Procedure**
  Apply the spray glaze as described on page 20/21.

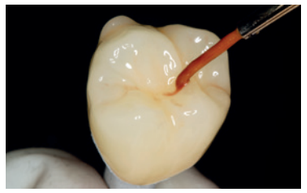
Smooth out displaced IPS Object Fix Putty or Flow using a plastic spatula so that the pin is securely in place and the crown margins are optimally supported.

Stains/Glaze firing in one step

- Before starting the characterization and glazing procedure, make sure the outside of the restoration is dry and free of auxiliary firing paste.
- If characterizations are desired, the restoration can be individualized using IPS e.max CAD Crystall./Shades and IPS e.max CAD Crystall./Stains.
- Extrude the ready-to-use shades and stains from the syringe and mix them thoroughly.
- The shades and stains may be slightly thinned using IPS e.max CAD Crystall./Glaze Liquid. However, the consistency should still remain pasty.
- Apply the mixed shades and stains directly to the restoration using a brush.

Please observe the following procedure for the application of the IPS e.max CAD Crystall./Glaze Spray:
See page 21.

Extrude IPS e.max CAD Crystall./Shades and Stains from the syringe and mix them thoroughly. Dilute with IPS e.max CAD Crystall./ Glaze Liquid if required.



Apply the mixed IPS e.max CAD Crystall./Shades and Stains.

Even spray glaze layer.

Optional:

- If additional characterizations or adjustments are required after crystallization, a corrective firing using IPS e.max CAD Crystall./Shades/Stains and Glaze/Fluo can be conducted. Also use the IPS e.max CAD Speed Tray for the corrective firing.
- Use the IPS e.max CAD Crystall./Add-On to carry out minor shape adjustments (e.g. proximal contact points). Adjustments can be made using the corrective firing (does not apply to the Programat CS4, CEREC® SpeedFire).
- The detailed procedure is described on page 31.

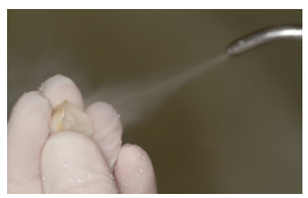
- Remove the ceramic objects from the furnace after completion of the firing cycle (wait for the acoustic signal of the furnace).
- Allow the objects to cool to room temperature in a place protected from draft.
- Do not touch the hot objects with metal tongs.
- Remove the cool restoration from the set IPS Object Fix Putty or Flow.
- Remove any adhering residue with ultrasound in a water bath or with the steam jet.
- If the restoration needs to be adjusted by grinding, make sure that no overheating of the ceramic occurs.

Conduct the Add-On firing under vacuum on an IPS Speed Tray using the stipulated firing parameters.

Firing parameters see page 38.

Remove the cool restoration from the set IPS Object Fix Putty or Flow.

Remove adhering residue with ultrasound in a water bath....



... or with the steam jet.

Adjustments

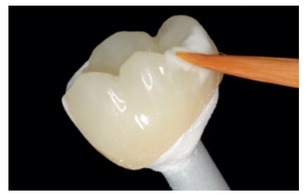
Adjustments with IPS e.max CAD Crystall./Add-On

Use the IPS e.max CAD Crystall./Add-On to carry out minor shape adjustments (e.g. proximal contact points).

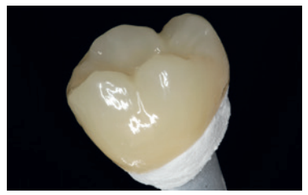
Procedure:

- Mix IPS e.max CAD Crystall./Add-On with IPS e.max CAD Crystall./Add-On Liquid to an easy-to-contour consistency.
- Ensure even mixing of the Add-On material and the liquid in order to achieve an optimum firing result.
- Apply the mixed Add-On material directly onto the unfired Glaze Paste and/or Shades and Stains in the areas to be adjusted and fire.
- If the Glaze Spray is used, apply the Shades and Stains first. Subsequently, supplement the missing areas using Add-On. Apply the Glaze Spray immediately after the application of the Add-On and fire.
- After having applied the add-on material, conduct the corrective firing.

Mix IPS e.max CAD Crystall./Add-On with IPS e.max CAD Crystall./Add-On Liquid to an easy-to-contour consistency.



Apply the mixed Add-On material.



Completed crown

Conduct the Add-On firing under vacuum (e.g. Programat CS3, Programat CS6) on an IPS Speed Tray using the stipulated firing parameters (not with Programat CS4 and CEREC® SpeedFire).

Firing parameters see page 38.

Cementation

Cleaning

In order to ensure optimum cementation results, we recommend cleaning the bonding surfaces after intraoral try-in. The universal cleaning paste Ivoclean effectively cleans the bonding surfaces of prosthetic restorations after intraoral try-in.

Cementation options

Esthetic cementation options are essential for achieving a harmonious shade effect in all-ceramic restorations. IPS e.max ZirCAD Prime restorations can be conventionally, self-adhesively or adhesively cemented.

- We recommend using ZirCAD Cement for the conventional cementation of IPS e.max ZirCAD Prime.
- Speedcem® Plus is suitable for the self-adhesive cementation of IPS e.max ZirCAD Prime.
- Variolink® Esthetic is the ideal luting composite for the adhesive cementation of IPS e.max ZirCAD Prime restorations.

Short definition of the different cementation options:

- **Conventional cementation**
  In conventional cementation, the restoration is held in place mainly by static friction between the luting material and the restoration as well as the luting material and the prepared tooth. In order to maintain this static friction, a retentive preparation with a preparation angle of approx. 4–8° is required. Conventional cementation does not result in an increase of the (overall) strength of the ceramic restoration.
- **Self-adhesive cementation**
  As the luting material features self-adhesive properties to the tooth structure, no additional pre-treatment of the tooth surface is required. The restoration is held in place partly by micromechanical retention and partly by chemical bonding. To achieve sufficient bonding strength, a retentive preparation (preparation angle of 4–8°, preparation height of at least 4 mm) is recommended. Self-adhesive cementation does not result in an increase of the (overall) strength of the all-ceramic restoration.
- **Adhesive cementation**
  When using adhesive cementation, the tooth surface is chemically conditioned with a liquid bonding agent. This results in a micromechanical and chemical bond between the tooth structure and the luting material after the curing process. Therefore, a retentive cavity preparation, which would entail more loss of healthy tooth structure, is not required. Depending on the luting material, the chemical bond between the composite and the restoration can be achieved with the help of an appropriate primer.

Preparing for cementation

The conditioning of the restoration and the preparation depends on the chosen cementation method and luting material. Below is a description of the basic working steps required for preparing the restoration for cementation.

Conditioning the restoration

Conditioning the ceramic surface to prepare it for cementation is an essential working step to achieve a reliable bond between the luting material and the all-ceramic restoration. When cementing IPS e.max ZirCAD Prime restorations, observe the following procedure:

- Prior to seating, condition the IPS e.max ZirCAD Prime restoration by blasting its inner aspects with Al_2O_3, 25–70 µm, 1 bar (14.5 psi) or Al_2O_3, 70–110 µm, 1.5 bar (21.75 psi).
- Thoroughly rinse the IPS e.max ZirCAD Prime restorations with water and blow dry.
- Saliva can easily be removed from the restoration with the help of Ivoclean.
- If adhesive cementation is used, condition the bonding surface using Monobond® Plus.

	IPS e.max ZirCAD Prime		
Types of restorations	Crown, bridge		
Cementation method	conventional	self-adhesive	adhesive
Blasting	Al_2O_3, 25–70 µm, 1 bar (14.5 psi) or Al_2O_3, 70–110 µm, 1.5 bar (21.5 psi)		
Cleaning after try-in	Ivoclean		
Conditioning	–		60 s with Monobond® Plus
Cementation	ZirCAD® Cement	Speedcem® Plus	Variolink® Esthetic

Conditioning the preparation

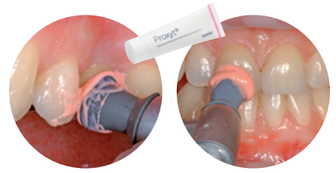
Before you condition the restoration, try it in and check the occlusion and articulation. If the restoration required adjustments, the areas that have been adjusted must be polished extraorally before final seating. Any saliva can easily be removed from the restoration with the help of Ivoclean. How you condition the preparation depends on the cementation material used and should be carried out following the specific instructions for use.

Adjustments in the oral cavity

If you need to make functional adjustments by grinding in the oral cavity, use suitable diamond grinding tools along with water cooling. Then, the areas where the adjustments have been made should be carefully polished and restored to their original condition. For polishing, we recommend using OptraGloss® for intraoral use. Please refer to the Ivoclar recommendations for polishing and grinding tools on page 40.

Care notes

Same as natural teeth, high-quality IPS e.max ZirCAD Prime restorations require regular professional care. This benefits both the health of the gums and teeth, as well as the overall esthetic appearance. With the pumice-free Proxyt® pink polishing paste, surfaces can be maintained without causing wear. The low RDA* value = 7 (*Relative Dentin Abrasion) provides assurance that cleaning is done with a low-abrasion cleaning paste. Scientific studies and years of clinical experience confirm the gentle effectiveness compared to other pastes.



Cervitec® Plus is a protective varnish for professional application both in dental practices and field conditions to help maintain the longevity of teeth, crowns, bridges, implants and removable prosthetics. The varnish contains the proven combination of active ingredients of 1% chlorhexidine and 1% thymol. The areas of application are:

- protection of exposed root surfaces,
- treatment of hypersensitive tooth necks,
- reduction of bacterial activity on the tooth surface.

Please observe the respective Instructions for Use.

General information

Frequently asked questions

Material

1. What lies behind the IPS e.max ZirCAD Prime block concept?

The "Prime" concept combines the best of three material worlds into a single block:

I. In the dentin zone, we have achieved the highest possible flexural strength with the 3Y-TZP material (1100 MPa [a] dentin; typical mean value of flexural strength (ISO 6872), Ivoclar Vivadent AG, Schaan, Liechtenstein [b] dentin; Vickers indentation method (ISO 6872), Ivoclar Vivadent AG, Schaan, Liechtenstein) and fracture toughness (4.4 MPa $m^{½}$).
II. The middle part comprises 4Y-TZP (MT, medium translucency).
III. In the incisal zone, we have the highest possible translucency (5Y-PSZ) to ensure a natural appearance of the restoration made from IPS e.max ZirCAD Prime.

2. Are the IPS e.max ZirCAD Prime blocks and the IPS e.max ZirCAD Prime discs the same material?

No. The block is designed for quick processing at chairside. So, the composition, process and manufacturing parameters are similar but there are also differences.
This has resulted in different preparation guidelines and sintering times.

3. Why are the minimum layer thicknesses for the IPS e.max ZirCAD Prime block different from those for the IPS e.max ZirCAD Prime disc?

In principle, the design parameters of the IPS e.max ZirCAD Prime block and the IPS e.max ZirCAD Prime disc are identical, especially as regards the connector dimensions for multi-unit bridges. As a result of redesigning the transition zone in the blocks, the high-strength dentin zone extends over a larger area (2/3 of the block height). This makes it possible to reduce the minimum layer thickness to 0.8 mm for posterior crowns and abutment teeth of 3-unit bridges. As the IPS e.max ZirCAD Prime blocks are specifically developed for the chairside workflow and full-contour restorations, no design parameters for frameworks are communicated.

4. How large can the design of a crown or bridge be at maximum to still be fabricated from a C17 or B50 block?

	Block	Block dimensions Width x Length x Height	Max. dimensions sintered restoration MD (mesial/distal) x LL (labial/lingual) x CO (cervical/occlusal)
Crown	C17	W 17 x L 19 x H 21 mm	MD 14 x LL 14.5 x CO 12.5 mm
Bridge	B50	W 17 x L 19 x H 49 mm	MD 37 x LL 14.5 x CO 12.5 mm

5. What are the requirements for using the IPS e.max ZirCAD Prime blocks?

The complete list of compatible CAD/CAM systems is available at www.ivoclar.com.
In the USA, usage is possible in conjunction with CEREC® starting from SW version 5.2.9.

6. How should a restoration be positioned in the block?

The software positions the restoration in such a way that it can be processed optimally by the milling machine. To adjust the esthetic appearance, the restoration can be moved upwards into the more translucent area or downwards into the more opaque, high-strength area.
Therefore, crowns should generally be positioned towards the upper region of the block. For bridges, it is important to ensure that the connectors are positioned in the dentin zone within the lower two thirds of the block.

7. Which milling strategy should be used?

Depending on the CAD/CAM system, various milling strategies validated by Ivoclar are available to choose from.
Generally, dry milling is preferable to wet milling to prevent potential contaminations and save time by eliminating the need for predrying.
With especially fast milling strategies, fissures are typically milled with less detail, and more effort may be required to smooth the surface after milling.
Milling strategies optimized for reproducing subtle details and achieving a high surface quality require a longer processing time in the milling machine.

8. Can you sinter restorations made from an IPS e.max ZirCAD Prime disc with the same sintering programs as restorations made from a block?

No. The IPS e.max ZirCAD Prime blocks have been specifically developed to be processed particularly quickly at chairside. Restorations made from discs must never be sintered using programs that are designed for the blocks and included, for instance, in the Programat CS6. The sintering programs designed for the respective version must be followed to achieve the intended properties of the material.

Dentin, according to Vickers indentation method (ISO 6872), Ivoclar Vivadent AG, Schaan, Liechtenstein
Dentin, typical mean value of flexural strength (ISO 6872), Ivoclar Vivadent AG, Schaan, Liechtenstein

Sintering

9. Do you have to pretreat IPS e.max ZirCAD Prime restorations before you sinter them?

It is important to clean the restorations before sintering them and remove any adhering zirconium oxide dust. However, the restoration must not be cleaned in an ultrasonic bath or with a steam cleaner and it must not be blasted with Al_2O_3 or glass polishing beads. If the restoration has come into contact with liquids, it must be dried before it is sintered.

10. Why do bridge pontics have to be supported during sintering?

At the high sintering temperatures, the bridge attains a self-deforming state. To guard the bridge from distortion, the pontic with the biggest volume and/or mass should always be supported to prevent any warpage.

11. Which furnaces can be used to sinter IPS e.max ZirCAD Prime restorations made from blocks?

Currently, only the sinter furnaces Programat CS6, Programat CS4 and CEREC SpeedFire are approved for sintering IPS e.max ZirCAD Prime restorations made from blocks. Only the specified programs may be used for sintering.
Precise temperature calibration is essential due to the short sintering cycle times. Miscalibrations will have a significant impact on the final result. Failure to achieve the desired shade and translucency may be attributed to an inadequately low final temperature, which may stem from incorrect calibration.

12. From which software version onwards are the sintering programs for the IPS e.max ZirCAD Prime blocks integrated into the furnace?

– Programat CS6: starting from software version 1.2
– Programat CS4: starting from software version 1.2
– CEREC SpeedFire: In the USA, starting from CEREC software 5.2.9
In other markets, starting from CEREC SW 5.2.10

13. Which restorations made from a B50 block can be sintered in the CEREC® SpeedFire sintering furnace?

The B50 block has been developed to be able to produce even 4-unit bridges. In the CEREC® SpeedFire sintering furnace, only restorations with a maximum length of 38 mm can be sintered. The length of the restoration design must not exceed 30.5mm.

Polishing

14. For which types of materials can you use OptraGloss Extra Oral and Optra Gloss (intraoral)?

OptraGloss Extra Oral can be used for ceramics and glass-ceramics.
IPS e.max ZirCAD Prime, IPS e.max CAD and IPS Empress CAD have been specifically validated. OptraGloss is suitable for ceramics, glass-ceramics and resin composites.

15. Can you polish restorations made from an IPS e.max ZirCAD Prime block before you sinter them?

Restorations made from an IPS e.max ZirCAD Prime block can be pretreated before sintering, for instance to remove artifacts caused by the milling process or to apply minor shape adjustments. For this purpose, only the Spiral Wheel polisher shape should be used, applying gentle pressure and adhering to the recommended rotational speed. The restoration must be dry for this.
As the surface will change again during sintering, all surfaces should be polished again after sintering to keep plaque accumulation as low as possible and achieve a higher gloss. In order to minimize the wear of antagonists, the functional areas in particular must be polished to a high gloss after sintering.

16. Is pre-polishing with OptraGloss Extra Oral sufficient and can polishing in the mouth be omitted?

Pretreatment in the presintered* state is possible, but does not replace polishing of the final sintered restoration. In the sintered state, high-gloss polishing should be carried out on all surfaces to minimize abrasion on the antagonist. Polishing also reduces roughness, which helps minimize plaque accumulation. Additionally, a higher gloss can be achieved. Intraoral polishing is only necessary if adjustments by grinding have been applied after seating the restoration in the mouth. In this case, the affected areas should be re-polished to a high gloss.
To prevent contamination, restorations that have been tried in or placed permanently may no longer be polished with OptraGloss Extra Oral. In these cases, the reusable OptraGloss polishers should be used.

17. Is the final result the same regardless of whether polishing is done before or after sintering?

No. Achieving the highest level of surface quality requires performing high-gloss polishing with the light blue polishers (HP) after sintering. This result does not depend on whether or not polishing is carried out on the material in its presintered* state.

18. Does the amount of time spent polishing the presintered material affect the final outcome?

Yes. Spending too much time on pre-polishing can lead to a deterioration in the level of polish. Polishing should only be done until any superficial artifacts from the manufacturing process are no longer visible and a uniformly smooth surface is achieved. Excessive pressure and inadequately high speeds can lead to unintentional removal of material.

19. How can you remove blue marks on presintered restorations?	Only use the Spiral Wheel polisher shape to minimize the occurrence of blue marks from the polisher. Severe discolourations can be removed by polishing again. It is crucial to maintain low pressure and low speed.
20. Is it possible to polish the restoration margins to the point where they become too thin?	Yes. When the coarser pre-polishers (OptraGloss Extra Oral PP) are used, material is still being removed. This is desired, for example, to eliminate artifacts from the milling process. In the area of the proximal contacts and crown margins, polishing should be done carefully to avoid unintended removal of material. Especially when polishing in the presintered* state, there is a risk of removing more material than desired. Therefore, special attention must be paid to use gentle pressure and adhere to the recommended speed.
21. What is the difference between polished restorations and glazed restorations?	Restorations (especially crowns) can be completed more quickly by polishing than glazing. With the polishing technique, the shade effect may differ from that of the shade guide. Depending on the degree of polishing, the shade effect/intensity is increased. If necessary, it is recommended to select a block shade that is one shade brighter than the target shade. Polished zirconia exhibits a mother-of-pearl effect due to its high light refraction, which can affect the esthetic result. This effect can be reduced by glazing. Since the glaze wears off over time, it is advisable to polish at least the areas of the functional surfaces before applying the glaze. In doing so, high-gloss polishing with diamond paste should be avoided. An excessively smooth surface can make the application of the glaze difficult.

Delivery forms

22. What block sizes and shades are available?	Initially, the block sizes C17 for crowns and B50 for bridges are being introduced. The following shades are available: BL1, BL3, 0, A1, A2, A3, A3.5, B1, B2, C2, D2

Miscellaneous

23. Where can I find the code for the shrinkage factor and how do I enter it?	As zirconium oxide shrinks during sintering, the restoration must be milled in a larger scale to account for this. The shrinkage factor is unique for each block and must be communicated to the CAD/CAM system. To manually enter it, you need to read the shrinkage factor from the block. The code always starts with an asterisk (*) symbol, followed by a 7-character string. In newer devices, the machine retrieves the shrinkage factor directly from the Data Matrix code printed on the block. If this method fails for any reason, you will need to enter the shrinkage factor manually.
24. Why can glazed and polished restorations have different appearances when they are compared directly?	When all-zirconia restorations are polished, they can develop a shiny, mother-of-pearl-like surface, which makes them look different.
25. What is the mother-of-pearl effect?	The mother-of-pearl effect is the iridescent effect of a polished surface in incident light. The same effect that occurs in sea shells. A similar phenomenon can be observed in well-polished zirconium oxide. Zirconium oxide demonstrates a high refractive index and, when polished well, a high reflection factor. At the interfaces, part of the incident white light is transmitted and part is reflected so that incident and reflected light beams may overlap, which has the effect that certain parts of the white light spectrum are cancelled and any possibly differing hues remain. As the shade effect/shade intensity increases depending on the degree of polishing, it is recommended, if necessary, to select a block shade that is one shade brighter than the target shade.

* The term "presintered" refers to the state of the blocks in which they are still porous but free of organic additives. In this state, the material can be easily processed. The restoration achieves its final density and properties only after undergoing the sintering process in the furnace. During this process, the restoration shrinks by approx. 25%.

26. What does affect the abrasion wear behaviour of ZrO_2 restorations?	Several laboratory studies have shown that the wear behaviour of zirconium oxide is not affected by the hardness, but the surface texture. Generally, the smoother and rounder the surfaces are, the less wear there is on the enamel antagonist. Furthermore, study findings indicate that the wear on the opposing dentition caused by all-zirconium oxide crowns is not considered to be a critical issue.
27. May IPS e.max ZirCAD restorations be blasted with Al_2O_3 or polishing beads?	Sintered zirconium oxide restoration surfaces have to be "sand blasted" prior to incorporation. Non-sintered zirconium oxide restorations must not be blasted with Al_2O_3 or polishing beads.
28. Does the high flexural strength affect the TMJ?	Several clinical studies with monolithic zirconium oxide crowns and bridges examined whether or not the restorations negatively affect the TMJ, masticatory muscles, periodontal ligament of the antagonists (increased tooth mobility) and/or their integrity. Over a period of up to five years, no connection between the occurrence of various clinical phenomena and the incorporation of monolithic zirconium oxide restorations was found.

Sintering and firing programs

The following points should be observed for ceramic furnaces used for the sintering of IPS e.max ZirCAD Prime:
- Use Ivoclar ceramic furnaces (e.g.Programat CS6) to conduct the sintering procedure.
- Before the first sintering and every six months after that, the furnace must be calibrated.
- Depending on usage, more frequent calibration may be necessary. Be sure to follow the manufacturer's instructions.
- Due to the short sintering cycle times, precise temperature calibration is essential. Miscalibrations will have a significant impact on the final result. Failure to achieve the desired shade and translucency may be attributed to an inadequately low final temperature, which may stem from incorrect calibration.

For sintering in the Programat CS6, please observe the following points:
- The restoration must be thoroughly cleaned.
- Place the restoration directly onto the sinter tray. The restorations must not touch each other.
- For superspeed sintering: max. 3 crowns.
- For standard sintering: max. 3 units or 1 bridge.
- Do not use any sinter beads.
- After the furnace has automatically opened, wait for the restoration to cool down and only remove it when the display lights up green.
- Do not touch the hot objects with metal tongs.
- Do not blast or quench the objects.

The feature to sinter IPS e.max ZirCAD Prime restorations in the Programat CS6 and CS4 is available starting from software versions 2.1. Please find the pre-installed program positions in the program table corresponding to the software version of your furnace.

For conducting the **Glaze/Stains firing**, please observe the following points:
- Use only IPS Object Fix Putty or Flow as an auxiliary firing paste to place the restoration directly on the IPS Speed Tray. Position the IPS Speed Tray directly on the sinter tray.
- IPS e.max ZirCAD Prime restorations must not be directly placed on the IPS Speed Tray and/or pins without auxiliary firing paste.
- Only use the IPS Speed Tray and the pins that belong to it.
- After completion of the firing cycle, remove the IPS e.max ZirCAD Prime objects from the furnace.
- Allow the objects to cool to room temperature in a place protected from draft.
- Do not touch the hot objects with metal tongs.
- Do not blast or quench the objects.

For conducting the **Add-On firing**, please observe the following points:
- Always carry out the Add-on firing under vacuum (e.g. Programat CS3 or CS6.. Programat CS4 and CEREC® SpeedFire do not offer a vacuum function).

IPS e.max ZirCAD Prime

Corrective/Stains/Glaze firing *with* IPS e.max CAD Crystall./ materials

Furnace Programat		Stand-by temperature B [°C]	Closing time S [min]	Heating rate t ↗ [°C/min]	Firing temperature T1 [°C]	Holding time H1 [min]	Heating rate t ↗ [°C/min]	Firing temperature T2 [°C]	Holding time H2 [min]	Vacuum 1 11 12 [°C]	Vacuum 2 21 22 [°C]	Long-term cooling L [°C]	Cooling rate tl [°C/min]
CS6[a]		–	Glaze[c]	150	700	0:00	75 30[d]	830 890[d]	00:00 00:20[d]	50	815	850	-70
CS4[b]		180[c] 230[c]	0:00 03:00[c] 03:00[c]	60	400	0:00	95 45[d]	840 900[d]	0 3[d]	–	–	890	-70
CS3		403	6:00	90	830	0:10	30	870	3:00	450/830	830/869	0	0
CS2		403	6:00	90	830	0:10	30	870	3:00	450/830	830/869	0	0
CS		403	6:00	90	820	0:10	30	860	3:00	450/820	820/859	0	0

IPS e.max ZirCAD Prime

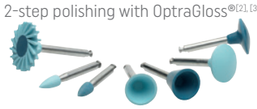
Corrective/Stains/Glaze firing *with* IPS e.max CAD Crystall./ Add-On

Furnace Programat		Stand-by temperature B [°C]	Closing time S [min]	Heating rate t ↗ [°C/min]	Firing temperature T1 [°C]	Holding time H1 [min]	Heating rate t ↗ [°C/min]	Firing temperature T2 [°C]	Holding time H2 [min]	Vacuum 1 11 12 [°C]	Vacuum 2 21 22 [°C]	Long-term cooling L [°C]	Cooling rate tl [°C/min]
CS6		–	Glaze[c]	150	700	0:00	75 30[d]	830 890[d]	00:00 00:20[d]	50	815	850	-70
CS4	–	–	–	–	–	–	–	–	–	–	–	–	–
CS3		403	6:00	90	830	0:10	30	870	3:00	450/830	830/869	0	0
CS2		403	6:00	90	830	0:10	30	870	3:00	450/830	830/869	0	0
CS		403	6:00	90	820	0:10	30	860	3:00	450/820	820/859	0	0

[a] IPS Speed Tray, max. 3 units or one bridge
[b] Place IPS e.max CAD Crystallization Tray on the sinter tray, max. 6 units
[c] Values for predrying
[d] Third heating stage

Polishing and grinding recommendations

IPS e.max ZirCAD
Zirconium oxide ceramic (ZrO_2)

Extraoral	
Smoothing out attachment points	 Fine diamonds or silicon carbide stones[1], [5]
Finishing	 Fine diamonds or fine tungsten carbide burs or silicon carbide stones[1], [5]
Pretreatment	**Optional:**  Pretreatment with OptraGloss® ExtraOral Spiral Wheel PP[1], [6] and OptraGloss® ExtraOral Spiral Wheel HP[1], [3]
Sintering	 Programat® CS6
Adjustments	Fine diamonds or silicon carbide stones[1], [5]
Polishing	 2-step polishing with OptraGloss® Extra Oral[1], [4]
Intraorally	
Extensive adjustments	 Fine diamonds[2], [4]
Small adjustments	 Fine diamonds[2], [4]
Polishing	2-step polishing with OptraGloss®[2], [3] 
Endodontic access	 Medium diamond

[1] Dry milling
[2] Wet milling
[3] Speed max. 10,000 rpm
[4] Speed max. 15,000 rpm
[5] Speed max. 20,000 rpm
[6] Speed max. 5000 rpm
– The respective manufacturer's instructions for the correct use of the grinding tools, e.g. low speed, must be observed.
–Regardless of the type of material being processed, generally use light pressure during grinding to prevent overheating.

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