IPS e.max® CAD

INSTRUCTIONS FOR USE

CE 0123

ivoclar vivadent® technical

TABLE OF CONTENTS

IPS e.max® System –
ALL YOU NEED

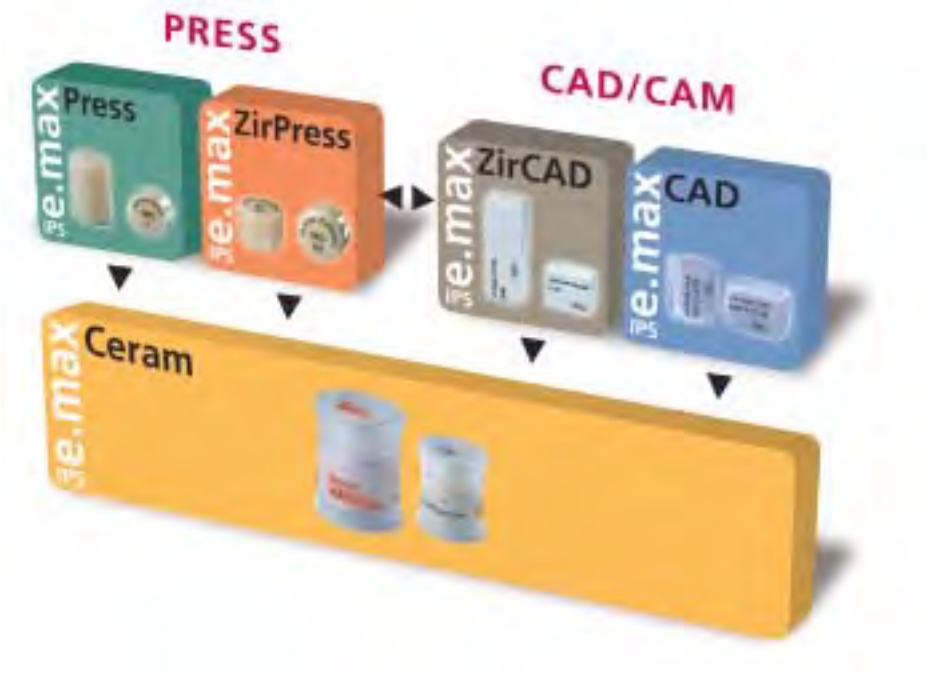
Your purchase of IPS e.max means you have chosen more than simply an all-ceramic system. You have taken the decision to benefit from the unlimited possibilities of all-ceramic. IPS e.max delivers high strength and highly aesthetic materials for the PRESS and the CAD/CAM technology.

The IPS e.max products are unique. They are recognized for their outstanding properties as well as exceptional versatility and flexibility – and they produce results with maximum aesthetics.

The components for the PRESS technique include the highly aesthetic glass-ceramic IPS e.max Press ingots and the glass-ceramic IPS e.max ZirPress ingots for pressing onto zirconium oxide. Depending on the case requirements, two types of materials are available for CAD/CAM techniques: the innovative IPS e.max CAD glass-ceramic blocks and the high-strength zirconium oxide IPS e.max ZirCAD.

The IPS e.max System is further enhanced by the nano-fluorapatite layering ceramic IPS e.max Ceram, which is used as a veneering material for all the IPS e.max components – either glass-ceramics or zirconium oxide ceramics.

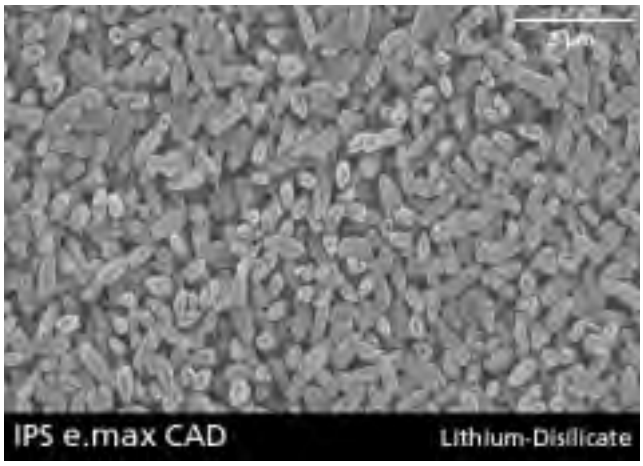
This proves that really exceptional all-ceramic systems are well designed. The system allows you to take advantage of a single, standardized layering scheme to offer your dentists and their patients restorations with maximum individuality and naturalness.



IPS e.max® CAD – PRODUCT INFORMATION

MATERIAL

IPS e.max CAD is a lithium silicate glass-ceramic block for the CAD/CAM Technology. It is manufactured in an innovative process, which results in the exceptional homogeneity of the material. In its crystalline intermediate state, the block can be easily milled with CAD/CAM equipment. The unusual colouring of IPS e.max CAD ranges between white, blue and bluish grey. This colour is created by the composition and microstructure of the glass-ceramic. The strength of the material at this machinable intermediary stage is 130 MPa. It is, therefore, comparable to other commercially available glass-ceramic blocks. After the IPS e.max CAD blocks have been milled, the material is crystallized in one of the Ivolcar Vivadent ceramic furnaces (eg P200, P300, P500, EP 600 Combi). The crystallization process is easy to conduct and takes 35 minutes. In contrast to some other CAD/CAM ceramics, the blocks do not shrink significantly and they do not require complicated infiltration processes.
The crystallization process at 850 °C (1562 °F) causes the microstructure to change through controlled growth of lithium disilicate crystals. The milling software takes the resulting densification of 0.2% into account in the milling process. The transformation of the microstructure produces the final physical properties including 360 MPa flexural strength and the suitable optical characteristics, such as shade, translucency and brightness.
The aesthetic tooth-coloured frameworks are veneered with IPS e.max Ceram.



CTE (100–400°C) [10^{-6} /K]*	10.2
CTE (100–500°C) [10^{-6} /K]*	10.5
Flexural strength (biaxial) [MPa]*	360
Fracture toughness [MPa $m^{0.5}$]*	2.25
Modulus of elasticity [GPa]	95
Vickers Hardness [MPa]	5800
Chemical resistance [µg/cm^2]*	40
Crystallization temperature [°C]	850

*according to ISO 6872

USAGE

Indications
- Anterior and premolar crowns
- Implant superstructures for single tooth restorations (anterior and premolar region)
- Primary telescope crowns

Contraindications
- Very deep subgingival preparations (adhesive cementation)
- Patients with severely reduced residual dentitions
- Bruxism

Important processing restrictions
Failure to observe the following restrictions may compromise the results achieved with IPS e.max CAD:
- The frameworks must not fall below the required minimum thickness
- Veneering ceramics other than IPS e.max Ceram must not be used
- The blocks must not be milled in a non-compatible CAD/CAM system
- Crystallization must not be conducted in a ceramic furnace that has not been calibrated
- Cyrstallization must not be conducted in a ceramic furnace that has not been tested
- Crystallization must not be conducted in a high-temperature furnace (eg Sintramat)

Side effects
If the patient is known to be allergic to any of the components of IPS e.max CAD, the product should not be used to fabricate restorations.

COMPOSITION

IPS e.max CAD Blocks and the matching working accessories are described below:

- **IPS e.max CAD Blocks**
  Components: SiO_2 > 57 % wt.
  Additional contents : Li_2O, K_2O, MgO, ZnO_2, Al_2O_3, P_2O_5 and other oxides

- **IPS Contrast Spray**
  Components: pigment suspension in ethanol; the propellant is fluoridated hydrocarbon

- **IPS Natural Die Material**
  Components: Polyester urethane dimethacrylate: 48–50 % wt.; paraffin oil: 4 % wt.; SiO_2, and copolymer: 47–50 % wt.

- **IPS Natural Die Material Separator**
  Components: Wax dissolved in > 95 % wt. hexane

QUESTIONS AND ANSWERS

Which type of plaster should be used to fabricate the models?

The instructions of the manufacturer of the CAD/CAM system in use should be observed in the fabrication of the models. The following basic rule applies: Depending on the CAD/CAM system and equipment, special plasters may have to be used for the fabrication of models and dies to ensure the quality of the scan. If a special scanning plaster is unavailable, models and dies can be fabricated with high-strength stone, which is sprayed with IPS Contrast Spray immediately before the scanning procedure.

What kind of preparation requirements must the die demonstrate in order to produce accurately fitting restorations?

The traditional preparation guidelines for all-ceramic restorations apply to IPS e.max CAD. The thickness of the incisal edge of prepared anterior teeth requires special attention. The prepared incisal edge should be at least as thick as the diameter of the bur used in the cavity. The corresponding instructions of the manufacturer regarding the dimensions of the grinding instruments must be observed during preparation.

Can an incisal edge, which has become too thin during preparation, be adjusted prior to scanning to avoid complicating the try-in procedure after machining?

In cases such as these, we recommend blocking out the incisal edge of the prepared die until the thickness matches that of the bur. These areas will be filled with luting cement when the restoration is seated.

Should manual adjustments with grinding instruments be done before or after the crystallization process?

All grinding adjustments of milled IPS e.max CAD restorations should be made in the precrystallized (blue) state. It is important to note that the framework in its precrystallized state should be ground only with suitable grinding instruments at low rpms and light pressure to prevent chipping, particularly at the margins.

Can machined IPS e.max CAD restorations in the pre-crystallized (blue) state be completely finished and then crystallized and veneered?

Milled IPS e.max CAD restorations can be tried in on the die and all areas fully finished in the precrystallized (blue) state. Special attention must be paid to the restoration margins in this state. The margins should be created in relation to the preparation and the thickness of the restoration. Margins that are too thin are not suitable for crystallization, as these areas are rounded during this process and therefore shortened. In these cases, the margins should be thinned out after the crystallization process.

Do IPS e.max CAD restorations shrink during crystallization?

During the crystallization process, the microstructure becomes transformed and densification of 0.2% takes place. The milling software takes this densification factor into account. Therefore, the milled IPS e.max CAD restorations demonstrate precision fit after cyrstallization.

Why does the IPS Object Fix paste have to be used during the cyrstallization process?

IPS e.max CAD restorations must not be placed on firing pins during cyrstallization due to a risk of distortion of the restoraton. Therefore, IPS Object Fix is used to position the restorations on the firing tray. The cavity of the restoration has to be completely filled with IPS Object Fix. Additional material is applied to form a base on which the restoration is supported on the firing tray.

Can firing pastes other than IPS Object Fix be used in the crystallization process?

IPS Object Fix has been specially developed for the crystallization of IPS e.max CAD restorations. In other words, the consistency before and after the crystallization allows the paste to be easily applied and cleanly removed. Other pastes must not be used as they are not easy to remove. Destructive blasting with Al_2O_3 or glass polishing beads is necessary to remove the pastes. Furthermore, other pastes may damage glass-ceramic surfaces because of their compositions.

Can other firing trays, eg "honeycomb" trays, be used for the crystallization of IPS e.max CAD?

No other firing trays should be used, as the silicon nitride tray in the matching assortment stores the heat, which is necessary to cool the glass-ceramic slowly without building up tension. Other firing trays, eg "honeycomb" trays, cannot store heat and therefore cool down too quickly, creating tension in the ceramic.

Can furnaces other than those from Ivoclar Vivadent be used to crystallize IPS e.max CAD restorations?

The crystallization of IPS e.max CAD is specially coordinated with the Ivoclar Vivadent ceramic furnaces (eg P200, P300, P500 and EP 600 Combi). If you would like to use other, untested ceramic furnaces, please consult Ivoclar Vivadent about their compatibility with IPS e.max CAD. It is important to note that not any ceramic furnace can be used for crystallization. Ceramic furnaces that do not feature a controlled long-term cooling mode cannot be used for this purpose.

Can the crystallization quality of IPS e.max CAD restorations be controlled?

Optical checks can be conducted with the help of the accompanying material shade guide. If the shade and opacity are comparable to that of the material shade guide, the crystallization process has been carried out successfully. The colours must always be compared on a neutral background in incident light. If the colour and opacity of the restorations are different from the shade guide, eg too translucent, a new restoration must be milled. Crystallization cannot be repeated.

Can IPS e.max Ceram Margin materials be used with IPS e.max CAD?

*IPS e.max Ceram Margin materials **must not** be used on glass-ceramics (IPS e.max Press and CAD), as the firing parameters are too high and the reduction for the shoulder would weaken the restoration.*

Can IPS Empress Universal Shades, Stains and Glaze be used on IPS e.max CAD?

*IPS Empress Universal Shades, Stains and Glaze have been specially developed for the IPS Empress System. They **cannot** be used with IPS e.max products.*

Can IPS e.max CAD frameworks be blasted with Al_2O_3 or glass polishing beads before they are veneered or after their completion (on the cavity side)?

*IPS e.max CAD restorations **must not** be blasted with Al_2O_3 or glass polishing beads before veneering and placement, as this would damage the ceramic surface and alter its properties.*

How must the internal (bonding) surface of IPS e.max CAD restorations be conditioned before cementation?

The internal (bonding) surfaces of IPS e.max CAD restorations must always be etched with hydrofluoric acid etching gel (IPS Ceramic Etching Gel) for 20 seconds, irrespective of whether they are cemented with adhesive or conventional methods. The retentive pattern created during etching generates a bond to luting composites as well as glass ionomer cements.

Can IPS e.max CAD restorations be conventionally cemented?

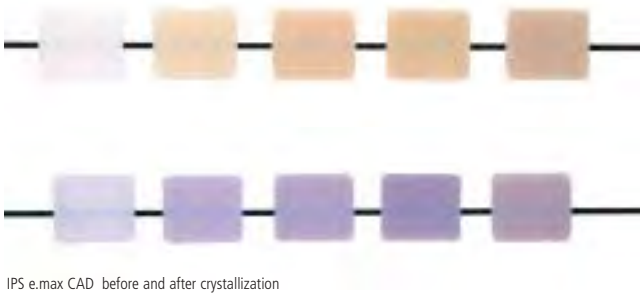
IPS e.max single tooth restorations can be both adhesively luted and conventionally cemented. If the restoration is to be conventionally cemented, the tooth has to demonstrate adequate retentive preparation. If this is not possible, adhesive luting should be preferred, eg with Variolink® II or Multilink®. Vivaglass® CEM is available for conventional cementation. It is not advisable to use classical phosphate cements, as they would negatively influence the light transmission of the all-ceramic and therefore compromise the aesthetic appearance of all-ceramic restorations.

BLOCK CONCEPT

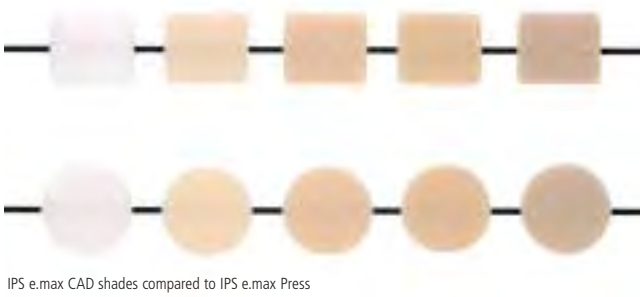
The shading and opacity of IPS e.max CAD Blocks is based on a newly developed translucency / opacity concept. The system is flexibly organized and can be used with the A–D and the Chromascop shade systems. The different levels of the concept are determined by indications and applications. The individual opacity and translucency levels are distinguished by means of a colour code.

Shade system	A–D Shades / Chromascop					Processing technique
Medium **O**pacity	MO 0	MO 1	MO 2	MO 3	MO 4	

IPS e.max CAD MO (Medium Opacity)
Because of their opacity, these blocks in shades MO 0– MO 4 are ideal for fabricating frameworks for restoring vital or lightly discolored teeth. Furthermore, they offer an ideal base for producing natural-looking restorations in A–D and Chromascop shades. The blocks are shaded according to specific shade groups. The fluorescence of the blocks decreases with the intensity of the shading



IPS e.max CAD before and after crystallization



IPS e.max CAD shades compared to IPS e.max Press

PRODUCT OVERVIEW AND DESCRIPTIONS

IPS e.max CAD for inLab® Basic Kit MO (Medium Opacity)

The IPS e.max CAD for inLab Basic Kit comprises all the blocks for the Sirona inLab system as well as the necessary working accessories. The Basic Kit is supplied in the new materials cabinet and can be expanded as desired with other IPS e.max Kits.

Delivery form:

IPS e.max CAD for inLab Basic Kit MO (Medium Opacity)

- 5x 5 IPS e.max CAD for inLab Blocks C14; Shades: MO 0, MO 1, MO 2, MO 3, MO 4
- 1x 50 ml IPS Contrast Spray
- 1x Silicon Nitride Firing Tray G
- 1x 12 g IPS Object Fix
- 1x IPS e.max CAD MO Shade Guide

IPS e.max CAD for inLab® MO (Medium Opacity) Blocks

IPS e.max CAD for inLab MO Blocks are available in one size (C14) and in 5 shades (MO 0, MO 1, MO 2, MO 3, MO 4)

Delivery form :

IPS e.max CAD for inLab MO Blocks Refill

- 5x 5 IPS e.max CAD for inLab Blocks C14; Shades: MO 0, MO 1, MO 2, MO 3, MO 4

sirona
The Dental Company

For the milling of IPS e.max CAD, a new milling tool is required. This new step-bur (CEREC/inLab Step-bur Diamon XL) can only be used for milling this material and from the inLab Software Version V2.70.

For information about the inLab® System, please contact;

Sirona Dental Systems GmbH
Fabrikstrasse 31
64625 Bensheim
Germany
E-mail: contact@sirona.de
www.sirona.com

IPS e.max CAD for Everest® Basic Kit MO (Medium Opacity)

The IPS e.max CAD for Everest Basic Kit comprises all the blocks for the KaVo Everest system as well as all the necessary working accessories. The Basic Kit is supplied in the new materials cabinet and can be expanded as desired with other IPS e.max Kits.

Delivery form:

IPS e.max CAD for Everest Basic Kit MO (Medium Opacity)

– 5x 5 IPS e.max CAD for Everest Blocks C14;
  Shades: MO 0, MO 1, MO 2, MO 3, MO 4
– 1x Silicon Nitride Firing Tray G
– 1x 12 g IPS Object Fix
– 1x IPS e.max CAD MO Shade Guide

IPS e.max CAD for Everest® MO (Medium Opacity) Blocks

IPS e.max CAD for Everest MO Blocks are available in one size (C14) and in 5 shades (MO 0, MO 1, MO 2, MO 3, MO 4).

Delivery form:

IPS e.max CAD for Everest MO Blocks Refill

– 5x 5 IPS e.max CAD for Everest Blocks C14;
  Shades: MO 0, MO 1, MO 2, MO 3, MO 4

KaVo. Dental Excellence

For information about the Everest® System, please contact:
KaVo Dental GmbH
Bismarckring 39
88400 Biberach
Germany
E-mail:info@kavo.com
www.kavo-everest.com

IPS Contrast Spray

IPS Contrast Spray is used for optimal imaging of CAD/CAM restorations. The IPS Contrast Spray evens out the different optical properties of the natural tooth (dentin and enamel) and of the plaster model and therefore allows an impeccable scan to be conducted. An optimal coating of the spray which clearly shows up all the edges is applied quickly and easily with the atomizer nozzle.

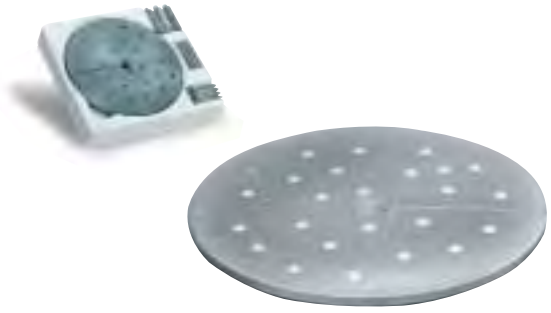
Delivery form:
IPS Contrast Spray
– 1x 50 ml [75 ml] IPS Contrast Spray

IPS Object Fix

IPS Object Fix is a paste that is used to support all-ceramic restorations during the firing and crystallization procedure. The paste stabilizes and secures the restorations in place on the silicon nitride firing tray and therefore facilitates firing. Its exceptional consistency allows IPS Object Fix to be applied with ease and simply removed after firing.

Delivery form:
IPS Object Fix
– 1x 12 g IPS Object Fix

Silicon Nitride Firing Tray G



The large firing tray is used in the crystallization of IPS e.max CAD restorations. The firing pins contained in the refill must not be used for the crystallization of IPS e.max CAD or for firing IPS e.max Ceram. These firing pins are only used to support metal-ceramic restorations.

Delivery form:
Silicon Nitride Firing Tray G
– 1x silicon nitride firing tray (large)
– 6x silicon nitride support pins (shape A)
– 3x silicon nitride support pins (shape B)
– 4x silicon nitride support pins (shape C)

IPS e.max CAD Materials Shade Guide

The IPS e.max CAD Materials Shade Guide allows the shade of the blocks to be determined in the dental practice or laboratory. Additionally, the shade samples show the colour of the different blocks after crystallization and can therefore be used to check the shade and quality of the crystallization process.

Delivery form:
IPS e.max CAD Materials Shade Guide
– 1x IPS e.max CAD Materials Shade Guide

IPS Natural Die Material

The light-curing IPS Natural Die Material simulates the shade of the prepared tooth and thus represents the optimum basis for natural shade reproduction of the given oral situation when fabricating all-ceramic restorations. IPS Natural Die Material is available in 9 shades. The shades were newly arranged and the assortment now contains all the shade variations necessary for the fabrication of lifelike all-ceramic restorations:

– 1 shade to imitate bleached preparations (ND 1)
– 1 shade to imitate secondary dentin that demonstrates an intensive shade (ND 6)
– 1 shade to imitate severely discoloured / devitalized preparations (ND 9)

The following chart shows the arrangement and designations of IPS Natural Die Material shades compared to those of the IPS Empress Die material.

IPS Natural Die Material	ND 1	ND 2	ND 3	ND 4	ND 5	ND 6	ND 7	ND 8	ND 9
IPS Empress Die Material	–	St 9	St 1	St 2	St 3	–	St 8	St 5	–

Delivery form:

IPS Natural Die Material Kit

– 9x 8 g IPS Natural Die Material,
  Shades: ND 1, ND 2, ND 3, ND 4, ND 5, ND 6, ND 7, ND 8, ND 9
– 1x 20 ml IPS Natural Die Material Separator
– 8x 10 IPS Condensers
– 8x 10 IPS Die Holders
– 2x Universal Holders
– 1x IPS Natural Die Material Shade Guide

IPS e.max® CAD – PRACTICAL USE

SHADE DETERMINATION

Chromascop

The Chromascop shade guide provides the shade standard for Ivoclar Vivadent products. The individual shades of the Chromascop are logically arranged and therefore allow shades to be determined accurately and efficiently. The 20 shades are divided into five shade groups. In addition, the Chromascop Bleach shade group comprises four very light shades. Once the basic hue has been established, the most suitable shade is chosen from within the shade group. All superfluous effects (eg cervical and translucent areas, severe discolourations in the incisal area and dentin as well as superficial characterizations) have been left out, making the selection of the proper shade much easier.

IPS Natural Die Material Shade Guide

In order to facilitate the reproduction of the tooth shade, dentists have the possibility of communicating the shade of the preparation of the given clinical situation to the dental laboratory using the IPS Natural Die Material shade guide. In this way, the fabrication of all-ceramic restorations is facilitated and a patient's individual characteristics can be taken into consideration.

IPS e.max CAD Materials Shade Guide

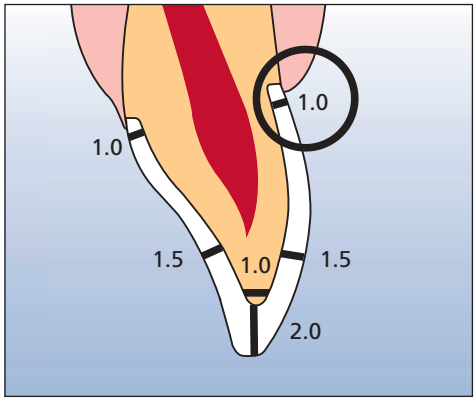
The IPS e.max CAD Materials Shade Guide allows the shade of the blocks to be determined in the dental practice or dental laboratory. The shade samples show the colour of the different blocks after crystallization.

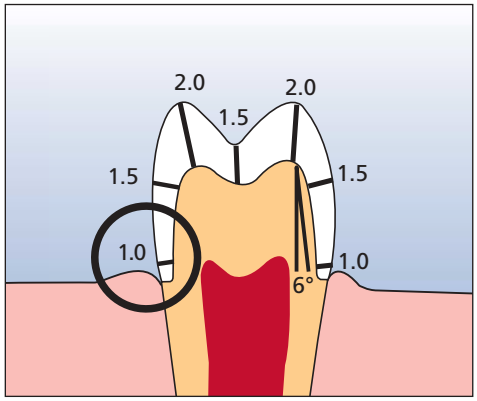
PREPARATION GUIDELINES AND MINIMUM THICKNESSES

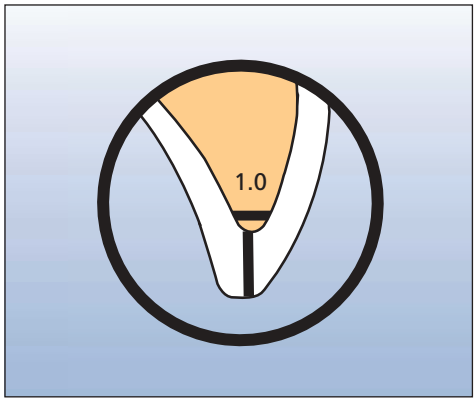
Successful results can only be achieved with IPS e.max CAD if the guidelines and framework thicknesses are strictly observed.

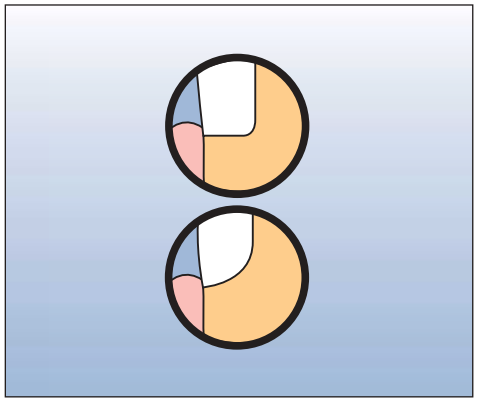
Anterior and premolar crowns

The anatomic shape is evenly reduced while observing the given minimum framework thickness. A circular shoulder is prepared with rounded inner edges or a chamfer at an angle of 10-30°: The width of the circular shoulder/chamfer is approx. 1 mm. Reduction of the crown third – incisal or occlusal by approx. 2 mm. For anterior crowns, the labial and palatal/lingual part of the tooth should be reduced by about approx. 1.5 mm. The incisal edge of the preparation should be at least 1mm (milling tool geometry) in order to permit optimum milling of the incisal edge during CAD/CAM processing.









FRAMEWORK DESIGN CRITERIA

The framework design is the key to the success of durable all-ceramic restorations. The more attention given to framework design, the better the final results and the clinical success will turn out to be. The following basic guidelines have to be observed:

- **The framework material is the high-strength component of your restoration and must, therefore, always make up at least 50 % of the total layer thickness of the restoration.**
- **In large preparations, the excess in available space must be compensated by the design of the framework and not by the layering material.**
- The areas that support and reinforce the shape and cusps of the restoration are constructed with the design tools of the different types of software used. In the Sirona inLab system this is done with the "form, drop and shape" application and in the KaVo Everest system with the "virtual wax knife".
- The lifelike translucency of IPS e.max CAD MO Blocks has been adjusted to the specified framework thicknesses.
- **A reduction of the framework thickness is always related to a reduction in strength, in value and in shade stability of the restoration.**
- If space is limited in areas that are not aesthetically significant (eg palatal area), veneers do not have to be applied. A fully anatomic shape can be created with the framework material in these places. In this case it is advisable to wax-up partially reduced restorations and scan them in.
- The integrated parameters in the software are basic recommendations. Depending of the overall thickness of the restoration it can be necessary to adjust the parameters.

		Anterior crowns	Premolar crowns
Minimum framework thickness	**circular**	min. 0.8 mm	min. 0.8 mm
	incisal	min. 0.8 mm	min. 1.0 mm
Design		supporting the tooth shape	supporting the tooth shape
Partially anatomic design		✔	✔

Maximum layer thickness of the veneering ceramic in mm	0.7	0.8	0.9	1.2	1.4
Minimum layer thickness of the framework ceramic in mm	0.8	1.0	1.1	1.3	1.6
Total layer thickness of the restoration in mm	**1.5**	**1.8**	**2.0**	**2.5**	**3.0**

If the above framework design criteria and minimum framework thickness are not observed, clinical failure of the restoration may occur, for example, in the form of cracks, delamination and fractures.

Anterior and premolar crowns

CEMENTATION

For the cementation of the IPS e.max restorations, you may select between the tried-and-tested adhesive luting composites and cements from the coordinated assortment of Ivoclar Vivadent. Adhesive cementation achieves a sound bond between the preparation and the cementation material, while conventional cementation requires a retentive preparation to ensure the durability of the IPS e.max restorations.

	Adhesive Cementation		Conventional Cementation	
	Variolink® II	**Multilink®**	**Vivaglass® CEM**	**PhosphaCEM**
IPS **e.max Press**	✓✓	✓✓	✓✓	–
IPS **e.max ZirPress** Veneers	✓✓	–	–	–
IPS **e.max ZirCAD**	–	✓✓	✓✓	✓
IPS **e.max CAD**	✓✓	✓✓	✓	–
IPS **e.max Ceram** Veneers	✓✓	–	–	–

✓✓ Especially recommended product combination

✓ Recommended product combination (2nd choice)

– Not recommended; product combination not possible

IPS e.max® CAD –
ANTERIOR AND PREMOLAR CROWNS

Model and die preparation

A model with detachable segments is fabricated as usual. The directions of the manufacturers of the different CAD/CAM systems regarding the plaster to be used must be observed. Attention must be paid to the following points during the preparation of the die:

– The thickness of the incisal edge of prepared anterior teeth (upper and lower) must be checked.
– The prepared incisal edge should be at least as thick as the diameter of the bur used in the cavity.
– If the incisal edge of the prepared die is thinner than the diameter of the bur, the incisal edge has to be blocked out accordingly.

CAD/CAM processing

As densification of about 0.2% takes place in IPS e.max CAD during the crystallization process, this factor has been taken into account in the software. Consequently, the milled IPS e.max CAD restorations demonstrate precision fit after crystallization. The fabrication steps are described in the directions for use and user manuals of the different CAD/CAM systems. The instructions of the manufacturers must be followed.

Sirona – inLab®

KaVo – Everest®

Milled IPS e.max CAD framework

Finishing and preparing for crystallization

It is of critical importance to use the correct grinding instruments for finishing and adjusting glass-ceramics. If unsuitable grinding instruments are used chipping of the edges and local overheating may occur (please see the corresponding recommendations from Ivoclar Vivadent).

The following procedure is recommended to finish IPS e.max CAD frameworks:

– Grinding adjustments of milled IPS e.max CAD frameworks must be made in the precrystallized (blue) state if possible.
– Only use suitable grinding instruments, low rpms and light pressure to prevent delamination and chipping at the edges in particular.
– Overheating of the glass-ceramic must be avoided.
– The frameworks are tried in on the dies and carefully finished.
– Make sure that the minimum thickness of the restoration is maintained during finishing.
– In the precrystallized (blue) state special attention must be given to marginal areas. Margins that are ground too thin are not suitable for crystallization, as these areas are rounded during this process and therefore become too short.
– Frameworks must always be cleaned with steam or in a water bath with ultrasound prior to crystallization.
– Frameworks **must not** be blasted with Al_2O_3 or glass polishing beads

Try in the milled framework on the model and check fit.

Finish the framework surface with suitable grinding instruments.

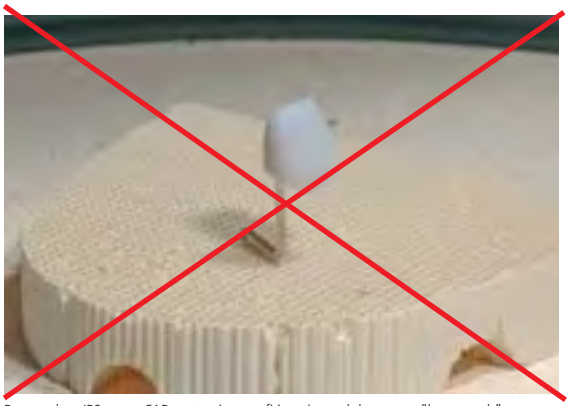
Make sure that the minimum thickness of the restoration is maintained during finishing.

Finish margins with suitable polishers.

Crystallization

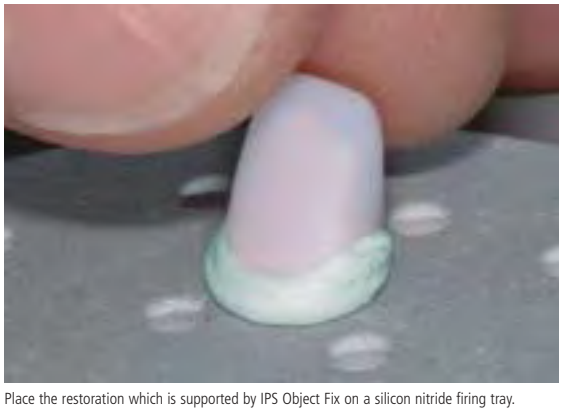
The following points should be observed for the crystallization of IPS e.max CAD:

– Crystallization should be carried out in an Ivoclar Vivadent furnace (eg P200, P300, P500 or EP 600 Combi).
– If a furnace from another manufacturer is used, Ivoclar Vivadent should be consulted to confirm the compatibility of the equipment with IPS e.max CAD. Generally, not every ceramic furnace can be used to conduct the crystallization process. For example, ceramic furnaces that do not feature a controlled (long-term) cooling mode cannot be used.
– Before conducting the first crystallization process, the furnace must be calibrated. Thereafter, it must be calibrated every six months.
– Depending on how the furnace is operated, it may have to be calibrated more frequently. It is important to observe the instructions of the manufacturer.
– Always carry out crystallization under vacuum.
– IPS e.max CAD restorations must not be placed on firing pins during crystallization.
– IPS Object Fix must be used to secure the restorations on the firing tray.
– The cavity of the restoration must be completely filled with IPS Object Fix and a base fabricated to prevent the restoration from touching the firing tray.
– Only the accompanying silicon nitride firing tray from Ivoclar Vivadent may be used for this purpose, as it is capable of storing the heat required for slow and stress-free cooling of the glass-ceramic.
– Always allow the restoration to cool to room temperature after the crystallization process and before it is finished.



Do not place IPS e.max CAD restorations on firing pins and do not use "honeycomb" trays.

Fill the cavity completely with IPS Object Fix and attach a base.



Place the restoration which is supported by IPS Object Fix on a silicon nitride firing tray.

Place the firing tray in the furnace and start the crystallization program.

IPS e.max CAD framework before crystallization

IPS e.max CAD framework after 35 minutes crystallization

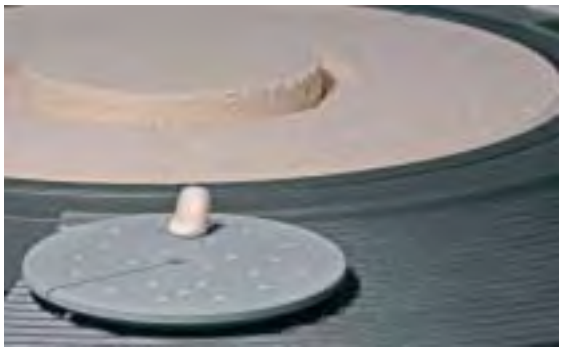
Crystallization parameters

	Closing time S	Stand-by temperature B	Heating rate t_1	Firing temperature T_1	Holding time H_1	Heating rate t_2	Firing temperature T_2	Holding time H_2	Longterm cooling L	Cooling rate t_k	Vacuum 1 1_1 1_2	Vacuum 2 2_1 2_2
P80	0:18 min.	400°C 752°F	–	–	–	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	700°C 1292°F	–	550°C / 1022°F 850°C / 1562°F	
P100 **P200**	0:18 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	700°C 1292°F	–	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 850°C / 1562°F
P300 **P500**	0:18 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	700°C 1292°F	20°C/min. 36°F/min.	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 850°C / 1562°F
PX1	0:30 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	775°C/1427°F 1:30 min. 700°C/1292°F 0:20 min.	–	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 850°C / 1562°F
EP 600 Combi	0:18 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	840°C 1544°F	10:00 min.	700°C 1292°F	–	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 840°C / 1544°F

Preparation for veneering

Once the IPS e.max CAD restoration has cooled to room temperature, proceed with the following steps:

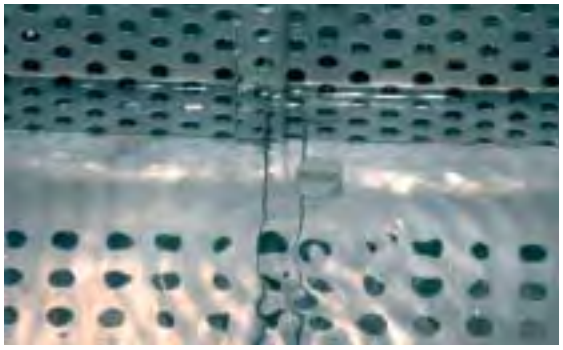
– Remove the restoration from the hardened IPS Object Fix.
– Remove any residue with ultrasound in a water bath and/or with steam
– Do **not** remove residue with Al_2O_3 or glass polishing beads.
– Place the restoration on the model and check the fit and if necessary make slight adjustments.
– Check margins and make small adjustments if necessary.
– Make sure that the minimum thickness of the restoration is maintained during finishing.
– Before veneering clean the restoration under running water or with steam.
– The framework must **not** be blasted with Al_2O_3 or glass polishing beads, as this would damage its surface.



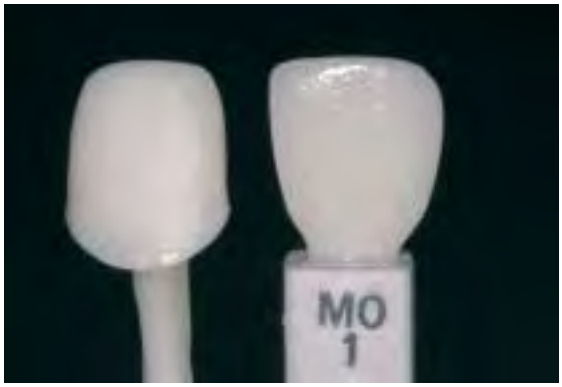
After the crystallization program, remove the firing tray from the furnace and allow the IPS e.max CAD restoration to cool to room temperature.

Remove restoration from the hardened IPS Object Fix.

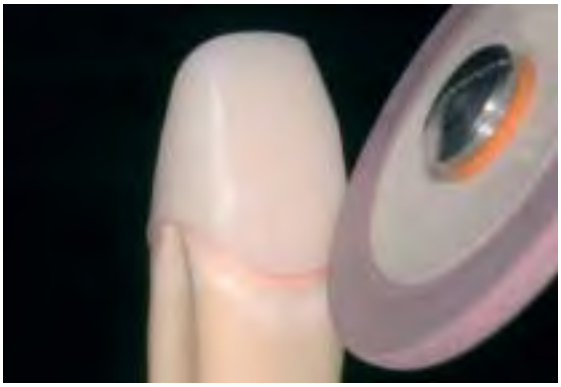
Do **not** remove residue with Al_2O_3 or glass polishing beads.



Remove residue with ultrasound in a water bath or with steam.



Conduct an optical inspection of the crystallization result using the IPS e.max CAD shade samples.



Place restoration on the model and check the fit and if necessary adjust slightly.

Finished IPS e.max CAD framework

Die fabrication with IPS Natural Die Material

The light-curing IPS Natural Die Material simulates the shade of the prepared tooth. A control die is fabricated using the shade information provided by the dentist (shade determination). This control die represents the optimum basis for a true-to-nature shade reproduction of the given oral situation.

– Coat the inner surfaces of the ceramic restorations with IPS Natural Die Material Separator and allow it to react for a short time.
– Apply die IPS Natural Die Material in the corresponding shade to the inner surfaces of the restoration using the IPS Condenser and adapt so that the entire inner surface is coated and filled.
– Completely fill the restoration cavity and insert an IPS Die Holder into the material and adapt excess material around the holder. Make sure that the Die Material is well adapted to the restoration margins and that no gaps are present.
– Polymerize the IPS Natural Die Material die with a commercial polymerization light, e.g. Lumamat 100, for 60 seconds.
– After polymerization, the die can be finished and or smoothed, if required.

Coat the inner surfaces of the ceramic restoration with IPS Natural Die Material Separator and allow it to react for a short time.

Completely fill the restoration cavity and insert an IPS Die Holder into the material and adapt excess material around the holder. Then, polymerize with a commercial polymerization light.

A die made of IPS Natural Die Material is the optimum basis for true-to-nature all-ceramic restorations.

Clean the framework under running water or with the steam jet before veneering.

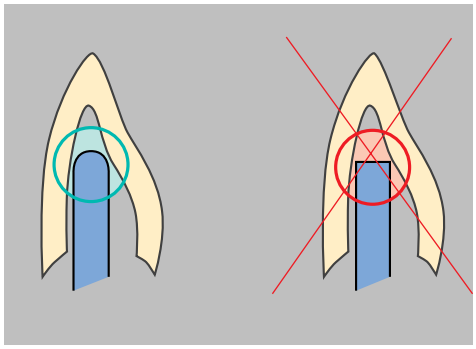
Do **not** blast the framework with Al_2O_3 or polishing beads.

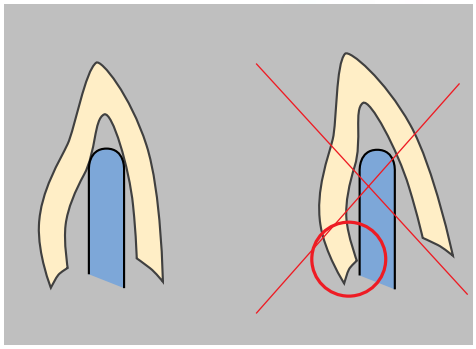
Veneering with IPS e.max Ceram

The following paragraphs will explain the most important veneering steps. Detailed information about the nano-fluorapatite ceramic and its processing are contained in the IPS e.max Ceram Instructions for Use.

Firing tray and pins

Use a honey-combed firing tray and the corresponding support pins to fire the restorations (do not use ceramic pins). Round the top edges of the support pin to prevent the object from sticking to the pin. Another method of reducing this risk is to cover the pins with platinum foil or a small amount of IPS Object Fix. Regularly clean the support pins. Do not use contaminated pins.





Wash firing (foundation firing)

The framework must be free of dirt and grease before the wash firing is done. Any contamination of the framework after cleaning must be prevented. Wash firing (Foundation) is carried out with Deep Dentin, Dentin or Shade and Essence materials (ZirLiner may not be used. Because of its firing temperature of 960 °C/1760°F it only works on zirconium oxide).

Variant A: Powder

With ideal space, conduct the wash firing (foundation) with the required Dentin or Deep Dentin material. Use the IPS e.max Ceram Build-Up Liquids (allround or soft) to mix the materials. If a more plastic consistency is desired, IPS e.max Ceram Glaze and Stain Liquids (allround and longlife) can be used. Apply the wash in a thin coat on the entire framework.

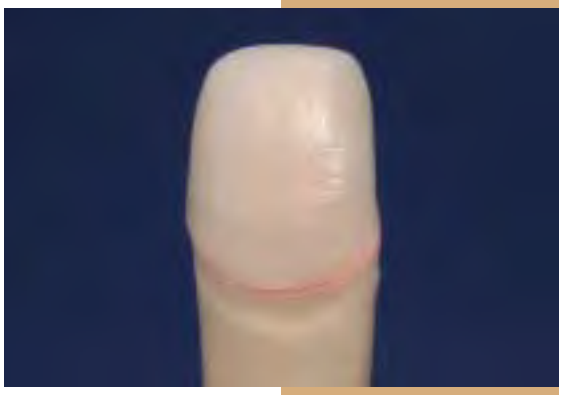
Apply the wash using Dentin or Deep Dentin material…..

…and fire using the indicated firing parameters.

Variant B: Paste

With limited space or to increase the in-depth chroma, the wash firing can be conducted using IPS e.max Ceram Shades and Essence. Mix the paste or powder with the IPS e.max Ceram Glaze and Stain Liquids (allround and longlife) to the desired consistency. Apply the wash in a thin coat on the entire framework.

Apply the wash using Shades and Essence materials…..



… and fire using the indicated firing parameters.

Firing parameters for the wash firing (foundation firing)

IPS e.max Ceram on IPS e.max CAD	B	S	t↗	T	H	V_1	V_2
Wash firing (foundation firing)	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F

Optional

Wash firing (foundation firing) characterization

Intensively characterized areas may be designed with IPS e.max Ceram Essence. These materials are ideally suited to apply individualized characterizations. When space is limited, the fully anatomical areas of the framework may be given a true-to-nature design at the beginning of the veneering procedure. These areas are covered with a fluorescent glaze (paste or powder).

Apply individualized characterizations using Essence…..

….. and fire in a separate characterization firing.

Firing parameters for the wash firing (foundation firing) characterization

IPS e.max Ceram on IPS e.max CAD	B	S	t↗	T	H	V_1	V_2
Wash firing (foundation firing) characterization	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F

Layering materials must not be applied on unfired wash layers (powders and pastes), since this will result in a delamination of the layering ceramic. The wash (foundation) must be fired before the actual layering procedure is started.

1st dentin and incisal firing

Carry out the layering according to the layering diagram. In order to achieve the desired consistency of the ceramic material, the IPS e.max Ceram Build-Up Liquids allound or soft can be used. If another consistency is required, the Liquids may also be mixed with each other using any mixing ratio.

Build-up the tooth shape using Dentin materials

Cut-back and build-up of the incisal area and incisal extension

Design the incisal third using Impulse materials

Complete the layering with Incisal and Transparent materials

Fire using the parameters for the 1st Dentin and Incisal firing

Firing parameters for the 1st dentin and incisal firing

IPS e.max Ceram on IPS e.max CAD	B	S	t↗	T	H	V_1	V_2
1st dentin/incisal firing	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F

2nd dentin and incisal firing (corrective firing)

Complete the missing areas and compensate for the shrinkage.

Compensate for the shrinkage using Dentin, Transparent, and Incisal materials

Fire using the indicated firing parameters for the 2nd dentin and incisal firing

Firing parameters for the 2nd dentin and incisal firing

IPS e.max Ceram on IPS e.max CAD	B	S	t↗	T	H	V_1	V_2
2nd dentin and incisal firing	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F

Stain and glaze firing

Stain firing is conducted with Essence and Shades, while glaze firing is carried out with glaze powder or paste. Depending on the situation, the firings may be conducted together or separately. The firing parameters are identical.

Stained and glazed IPS e.max CAD restoration

Firing parameters for the Stain and Glaze firing

IPS e.max Ceram on IPS e.max CAD	B	S	t↗	T	H	V_1	V_2
Stain firing	403°C 757°F	6' 6'	60°C 108°F	725°C 1337°F	1' 1'	450°C 842°F	724°C 1335°F
Glaze firing	403°C 757°F	6' 6'	60°C 108 °F	725°C 1337 °F	1' 1'	450°C 842 °F	724°C 133 °F

Preparation for delivery

Once the restoration has been completed in the laboratory, the inner surface of the IPS e.max CAD restoration must **not** be blasted using Al_2O_3 or polishing beads. The surface may be conditioned by etching with IPS Ceramic Etching Gel either in the laboratory or the dental office.

IPS e.max® CAD – GENERAL INFORMATION

PREPARING FOR CEMENTATION

Conditioning of the ceramic surface in preparation for cementation is decisive for generating a sound bond between the luting material and the all-ceramic restoration.

The following steps must be observed:
– High-strength glass ceramics are generally etched with hydrofluoric acid gel (IPS Ceramic Etching Gel) and, for adhesive cementation, silanated (Monobond S).
– Glass-ceramics must **not** be blasted with Al_2O_3 or glass polishing beads.

	IPS e.max CAD	
Indication	**Anterior and premolar crowns**	
Cementation method	Adhesive cementation	Conventional cementation
	✓	✓
Sandblasting	~~	
Etching	20 seconds with IPS Cermic Etching Gel	
Conditioning / Silanization	Monobond-S	~~
Cementation system	Variolink II Multilink	Vivaglass CEM

For the cementation of IPS e.max CAD restorations, you may choose between the tried-and-tested luting composites and cements of the coordinated assortment from Ivoclar Vivadent.

Please observe the IPS Ceramic Etching Gel Instructions for Use.

CRYSTALLIZATION AND FIRING PARAMETERS

Crystallization parameters

	Closing time S	Stand-by temperature B	Heating rate t_1	Firing temperature T_1	Holding time H_1	Heating rate t_2	Firing temperature T_2	Holding time H_2	Longterm cooling L	Cooling rate t_k	Vacuum 1 1_1 1_2	Vacuum 2 2_1 2_2
P80	0:18 min.	400°C 752°F	–	–	–	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	700°C 1292°F	–	550°C / 1022°F 850°C / 1562°F	
P100 **P200**	0:18 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	700°C 1292°F	–	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 850°C / 1562°F
P300 **P500**	0:18 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	700°C 1292°F	20°C/min. 36°F/min.	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 850°C / 1562°F
PX1	0:30 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	850°C 1562°F	10:00 min.	775°C/1427°F 1:30 min. 700°C/1292°F 0:20 min.	–	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 850°C / 1562°F
EP 600 Combi	0:18 min.	400°C 752°F	60°C/min. 108°F/min.	770°C 1418°F	5:00 min.	30°C/min. 54°F/min.	840°C 1544°F	10:00 min.	700°C 1292°F	–	550°C / 1022°F 770°C / 1418°F	770°C / 1418°F 840°C / 1544°F

Firing parameters

IPS e.max Ceram on IPS e.max CAD	B	S	t↗	T	H	V_1	V_2
Wash firing (foundation)	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F
Wash firing (foundation) characterization	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F
1st dentin/incisal firing	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F
2nd dentin and incisal firing	403°C 757°F	4' 4'	50°C 90°F	750°C 1382°F	1' 1'	450°C 842°F	749°C 1380°F
Stain firing	403°C 757°F	6' 6'	60°C 108°F	725°C 1337°F	1' 1'	450°C 842°F	724°C 1335°F
Glaze firing	403°C 757°F	6' 6'	60°C 108°F	725°C 1337°F	1' 1'	450°C 842°F	724°C 1335°F
Add-On with Glaze firing	403°C 757°F	6' 6'	60°C 108°F	725°C 1337°F	1' 1'	450°C 842°F	724°C 1335°F
Add-On after Glaze firing	403°C 757°F	6' 6'	50°C 90°F	700°C 1292°F	1' 1'	450°C 842°F	699°C 1290°F

- **The parameters listed represent standard values and apply to the Ivoclar Vivadent furnaces: P200, P300, P500, PX1 and EP 600 Combi. The temperatures indicated also apply to furnaces of older generations, such as the P20, P90, P95, P80, and P100. If one of these furnaces is used, however, the temperatures may deviate by ± 10 °C/50 °F, depending on the age and type of the heating muffle.**
- **If furnaces other than those from Ivoclar Vivadent are used, temperature adjustments may be necessary.**
- **Regional differences in the power supply or the operation of several electronic devices by means of the same circuit may render adjustments of the firing and press temperatures necessary.**

ANTERIOR AND PREMOLAR CROWNS

The listed combinations are standard possibilities for the IPS Natural Die Shades.

A–D	A1	A2	A3	A3.5	A4	B1	B2	B3	B4	C1	C2	C3	C4	D2	D3	D4
IPS e.max CAD	MO 1	MO 1	MO 2	MO 2	MO 4	MO 1	MO 1	MO 3	MO 3	MO 1	MO 4	MO 4	MO 4	MO 4	MO 4	MO 4
IPS Natural Die Material	ND 2	ND 2	ND 3	ND 4	ND 8	ND 2	ND 2	ND 5	ND 5	ND 2	ND 7	ND 7	ND 7	ND 7	ND 2	ND 3

Chromascop	010	020	030	040	110	120	130	140	210	220	230	240	310	320	330	340	410	420	430	440	510	520	530	540
IPS e.max CAD	MO 0				MO 1				MO 2				MO 3				MO 4				MO 4			
IPS Natural Die Material	ND 1				ND 2				ND 3	ND 3	ND 4	ND 4	ND 5				ND 7				ND 8			

Ivoclar Vivadent – worldwide

Ivoclar Vivadent AG
Bendererstrasse 2
FL-9494 Schaan
Liechtenstein
Tel. +423 235 35 35
Fax +423 235 33 60
www.ivoclarvivadent.com

Ivoclar Vivadent Pty. Ltd.
1 – 5 Overseas Drive
P.O. Box 367
Noble Park, Vic. 3174
Australia
Tel. +61 3 979 595 99
Fax +61 3 979 596 45
www.ivoclarvivadent.com.au

Ivoclar Vivadent GmbH
Bremschlstr. 16
Postfach 223
A-6706 Bürs
Austria
Tel. +43 5552 624 49
Fax +43 5552 675 15
www.ivoclarvivadent.com

Ivoclar Vivadent Ltda.
Rua Maestro João Gomes de
Araújo 50; Salas 92/94
Sao Paulo, CEP 02332-020
Brazil
Tel. +55 11 69 59 89 77
Fax +55 11 69 71 17 50
www.ivoclarvivadent.com

Ivoclar Vivadent Inc.
2785 Skymark Avenue, Unit 1
Mississauga
Ontario L4W 4Y3
Canada
Tel. +1 905 238 57 00
Fax +1 905 238 5711
www.ivoclarvivadent.us.com

Ivoclar Vivadent
Marketing Ltd.
Rm 603 Kuen Yang
International Business Plaza
No. 798 Zhao Jia Bang Road
Shanghai 200030
China
Tel. +86 21 5456 0776
Fax. +86 21 6445 1561
www.ivoclarvivadent.com

Ivoclar Vivadent
Marketing Ltd.
Calle 134 No. 13-83, Of. 520
Bogotá
Colombia
Tel. +57 1 627 33 99
Fax +57 1 633 16 63
www.ivoclarvivadent.com

Ivoclar Vivadent SAS
B.P. 118
F-74410 Saint-Jorioz
France
Tel. +33 450 88 64 00
Fax +33 450 68 91 52
www.ivoclarvivadent.fr

Ivoclar Vivadent GmbH
Dr. Adolf-Schneider-Str. 2
D-73479 Ellwangen, Jagst
Germany
Tel. +49 (0) 79 61 / 8 89-0
Fax +49 (0) 79 61 / 63 26
www.ivoclarvivadent.de

Ivoclar Vivadent
Marketing Ltd
114, Janki Centre
Shah Industrial Estate
Veera Desai Road,
Andheri (West)
Mumbai 400 053
India
Tel. +91 (22) 673 0302
Fax. +91 (22) 673 0301
www.ivoclarvivadent.firm.in

Ivoclar Vivadent s.r.l.
Via dell'Industria 16
I-39025 Naturno (BZ)
Italy
Tel. +39 0473 67 01 11
Fax +39 0473 66 77 80
www.ivoclarvivadent.it

Ivoclar Vivadent S.A. de C.V.
Av. Mazatlán No. 61, Piso 2
Col. Condesa
06170 México, D.F.
Mexico
Tel. +52 (55) 5062-1000
Fax +52 (55) 5553 1426
www.ivoclarvivadent.com.mx

Ivoclar Vivadent Ltd
12 Omega St, Albany
PO Box 5243 Wellesley St
Auckland, New Zealand
Tel. +64 9 914 9999
Fax +64 9 630 61 48
www.ivoclarvivadent.co.nz

Ivoclar Vivadent
Polska Sp. z.o.o.
ul. Jana Pawla II 78
PL-01-501 Warszawa
Poland
Tel. +48 22 635 54 96
Fax +48 22 635 54 69
www.ivoclarvivadent.pl

Ivoclar Vivadent
Marketing Ltd.
180 Paya Lebar Road
07-03 Yi Guang Building
Singapore 409032
Tel. 65-68469183
Fax 65-68469192

Ivoclar Vivadent S.A.
c/Emilio Muñoz, 15
Esquina c/Albarracín
E-28037 Madrid
Spain
Tel. + 34 91 375 78 20
Fax + 34 91 375 78 38
www.ivoclarvivadent.com

Ivoclar Vivadent AB
Dalvägen 14
S-169 56 Solna
Sweden
Tel. +46 8 514 93 943
Fax +46 8 514 93 940
www.ivoclarvivadent.se

Ivoclar Vivadent UK Limited
Ground Floor Compass Building
Feldspar Close
Warrens Business Park
Enderby
Leicester LE19 4SE
United Kingdom
Tel. +44 116 284 78 80
Fax +44 116 284 78 81
www.ivoclarvivadent.co.uk

Ivoclar Vivadent, Inc.
175 Pineview Drive
Amherst, N.Y. 14228
USA
Tel. +1 800 533 6825
Fax +1 716 691 2285
www.ivoclarvivadent.us.com

Date information prepared: 09/2005

Printed in Liechtenstein

597402/0406/e/BVD

ivoclar vivadent® technical