

# Quality forms noble metals



## DENTAL ALLOYS

Processing Manual



The fabrication of long-lasting, high-quality restorations that enhance the well being of the patient is a daily challenge in the dental laboratory. This task demands high-performance products and professional processing techniques. This manual provides useful information that will help you to use dental alloys correctly and thus achieve successful results.

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# Mission

Ivoclar Vivadent offers a comprehensive range of products for fabricating highly aesthetic and technically demanding dental restorations.

Apart from conducting research and developing innovative materials, we strive to supply you with products that are of a consistent high quality and outstanding bio-compatibility. The successful clinical application of our alloys confirms their high standard.



In order to process a material correctly, the user must know the material itself as well as the corresponding processing techniques. In addition to providing detailed instructions on how to process the individual products, we offer dental professionals continuing education opportunities at the ICDE (International Center of Dental Education). Our continuing education program is offered internationally to ensure the same high level of excellence throughout the world.

# Our know-how

A precision pattern, outstanding casting results and professional processing techniques form the prerequisites for fabricating long-lasting, functional restorations. Very often, technicians attempt to resolve problems without attempting to identify their origins.



As a result of our more than 100 years of experience in researching and producing dental alloys, we possess extensive know-how in this field and therefore offer reliable products and services.



This manual provides you with important information for fabricating dental restorations of consistent high quality.

# The pattern

## Framework fabrication using crown and bridge alloys

The framework is a smaller reproduction of the shape and contour of the tooth. Crowns must have a minimum thickness of 0.3 mm and abutment crowns must be of 0.5 mm in thickness after finishing to ensure adequate stability of shape. Retention aids must be provided, depending on the bonding system used. The lingual or/and occlusal surfaces are produced in metal or prepared for veneering according to the instructions of the manufacturer of the veneering material. The transition between the veneer and the metal framework must not be located in the occlusal stress-bearing region. The masticatory forces must be functionally supported in the incisal and occlusal regions.



## Framework fabrication using ceramic bonding alloys

The framework is a smaller reproduction of the shape and contour of the tooth. The dental ceramic is subsequently applied in an even layer. In the fabrication of frameworks, you must make sure that crowns demonstrate a minimum thickness of 0.3 mm and abutment crowns of 0.5 mm after finishing. These measurements are prerequisites for ensuring the strength of the metal framework and a longlasting metal-ceramic bond.



# Framework considerations

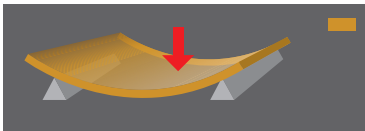


**The bridge wax pattern must take dimension and function into consideration**

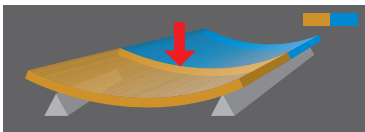
1. Wax pattern of the tooth
2. Reduction for the application of the veneering material
3. Forming of the points of contact and connections
4. Inspection of the occlusal and proximal points

**Important:**

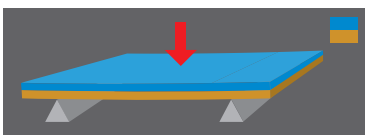
The diameter of the internal connectors and the wall thickness must be adequately designed according to the alloy used!  
The framework should be designed to give the ceramic proper support (ceramic thickness of max 2.0 mm).



- Single width of the connector  
= **standard strength**

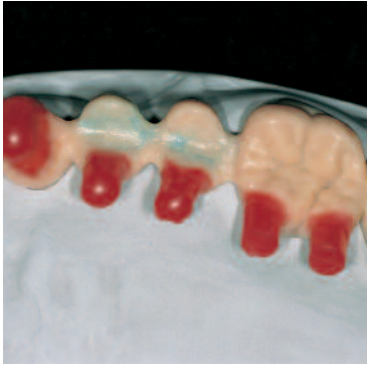


- Double width of the connector  
= **two-fold strength**



- Double height of the connector and single width  
= **eight-fold strength**

# Sprue design



Sprues are designed for unrestricted flow of the molten alloy to control the cooling process. Adequately sized sprues are essential.

The sprues must be attached to the thickest part of the pattern and should be approximately 2.5–3.5 mm in length. The sprue attachment should be flared.



The distance between the wax pattern and the reservoir allows the alloy to solidify quickly and evenly.

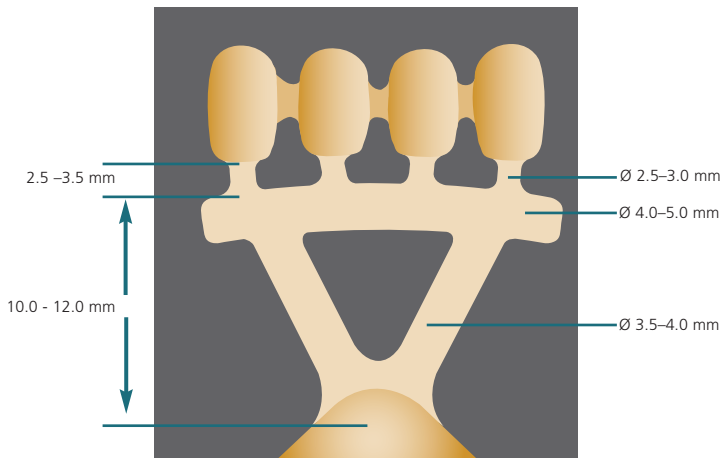
Particularly in bulky areas (interdental spaces, pontics or large crowns) cooling fins of 1 mm can be applied.

**The amount of the alloy required for the casting is calculated after the wax pattern and sprues have been weighed:**

$$\text{Weight of the wax pattern and sprues in grams} \times \text{density of the alloy} \\ = \text{required amount of alloy in grams}$$



# Investing

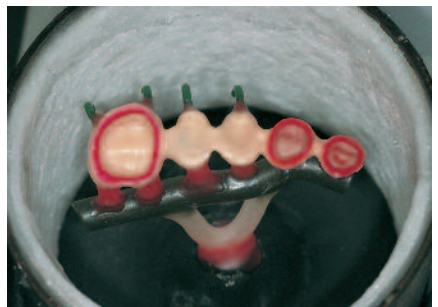


The reservoir must always be positioned in the hottest part of the ring and the wax pattern must be positioned in a cooler part of the ring.

If the sprues are correctly designed and the wax pattern suitably positioned in the casting ring, casting of the alloy is quickly accomplished and the solidification process is controlled.

**Use sprues with the largest possible diameter for casting palladium-based and base metal alloys.**

It is advisable to use a liner inside the investment ring to allow expansion of the investment material. When you select the casting ring, make sure that the investment will be sufficiently thick on the sides and the top.



# Investing and preheating



The best casting results are achieved if excess wax surface tension reducer is entirely removed and the setting time of the investment is observed.

It is essential that wax is completely eliminated during the preheating process.



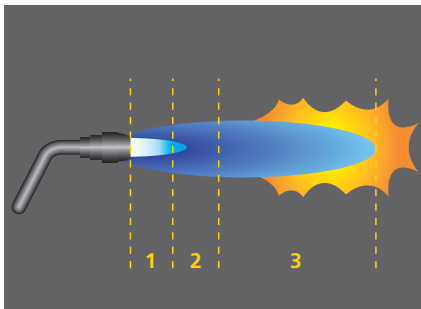
Phosphate-bonded or Gypsum-bonded investment materials are suitable for the investment procedure. Phosphate-bonded investment materials are suitable for conventional

or speed heating. Gypsum-bonded investment materials can only be used if the preheating temperature does not exceed 750 °C.

**The investment material is heated according to the instructions of the manufacturer. The prescribed final temperature is shown in the alloy chart and the Instructions for Use of the different alloys.**

# Melting methods

Ivoclar Vivadent alloys can be melted using an **electric resistance furnace**, a **propane-oxygen torch** or **high-frequency casting equipment**. The alloys can be melted either in a ceramic and/or graphite crucible (see alloy property chart). A separate crucible should be used for every alloy.



## Torch melting

- 1 Carbon-rich zone
- 2 Reduced zone
- 3 Oxidizing zone



1 = Carbon-rich flame



2 = Oxygen-rich flame



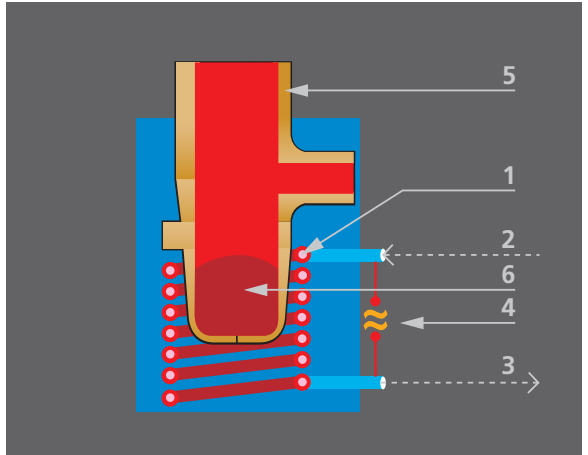
3 = Proper flame

**Alloys are melted in the reduced zone. If you use the Ivoclar Vivadent torch, we recommend that you work with 0.35 bar for propane and 0.7 bar for oxygen.**

# Melting methods

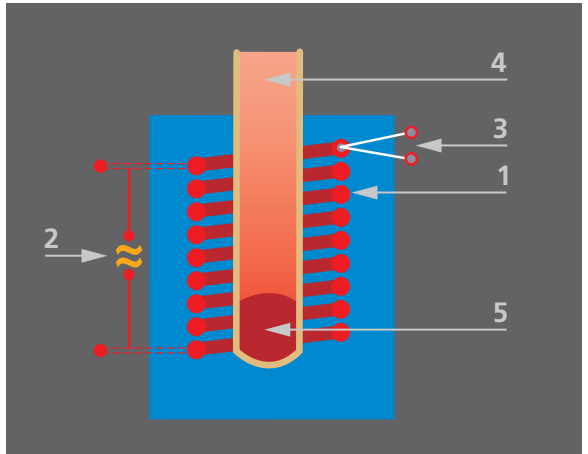
## Induction melting

- 1 High-frequency coil
- 2 Cooling water (inlet)
- 3 Cooling water (outlet)
- 4 High-frequency current
- 5 Crucible
- 6 Alloy



## Resistance melting

- 1 Heating spiral
- 2 Power supply
- 3 Thermocouple
- 4 Crucible
- 5 Alloy

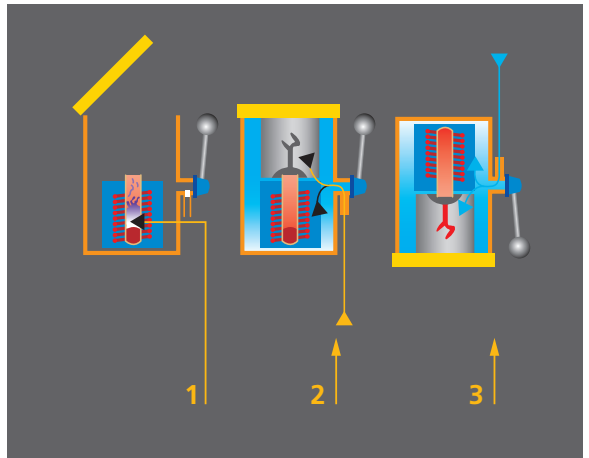


**Overheating of the alloy must be avoided. Please see the alloy chart for the casting temperature.**

# Casting methods

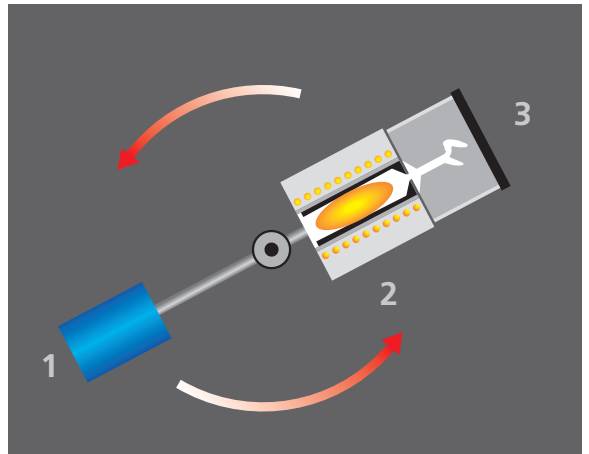
## Vacuum casting

- 1 Inert gas (argon)
- 2 Vacuum process
- 3 Compressed air process



## Straight arm centrifugal casting machine

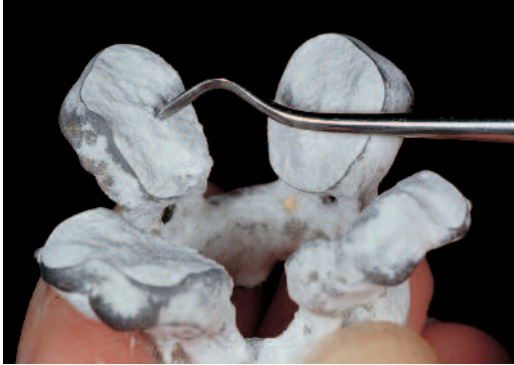
- 1 Counter weight
- 2 Thermocouple
- 3 Casting ring



**When you reuse precious and reduced gold alloys, the ratio of new material to used material is 1:1. Base metal alloys should never be reused.**

**Sprues/Sprue buttons must be carefully sandblasted before they are reused. Contamination with the abrasive must be avoided.**

# Divesting



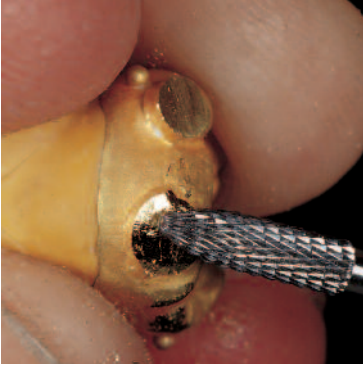
After the casting has been made, allow it to cool to room temperature. Next, carefully divest the piece using plaster shears. Remove the investment material within the casting using suitable instruments if possible.

**Do not use a hammer for the divesting to prevent damaging the metal structure.**



If you use an abrasive blasting device, we recommend using pure aluminium oxide ( $Al_2O_3$ ) grit measuring 50–100 microns and air pressure between 2–4 bar. (See Instructions for Use)

# Processing



Rotary tungsten carbide instruments or ceramic-bonded burs are used to **process crown and bridge alloys**. Polishing is done with rubber polishers of progressively smaller grit size as well as polishing brushes and polishing pastes. The entire framework has to be polished before the

veneering material is applied (see part on Polishing). Sandblast the contact surfaces with non recycled  $\text{Al}_2\text{O}_3$  grit according to the instructions of the manufacturer of the veneering material.



Tungsten carbide burs may be used for gross reduction. Ceramic-bonded grinding instruments are used for fine finishing of **ceramic bonding alloys**. Use different burs for every alloy to prevent contamination. It is advisable to use less speed and pressure on soft alloys.

**Always work in one direction on the metal surface to avoid overlaps and the formation of cavities.**

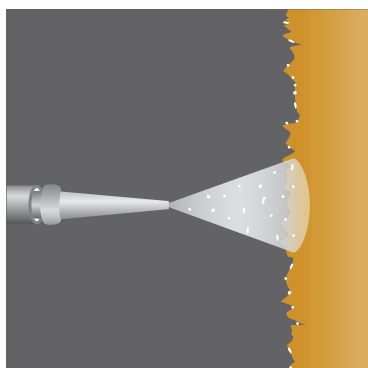
**Do not use diamond-coated instruments. Diamond particles may become embedded in the alloy and form bubbles in the ceramic during firing.**

# Processing



Correct angle to blast alloy surface

Carefully air abrade the framework with aluminium oxide of 50–100 micron grit size at approx. 2–4 bar. Air abrading improves the mechanical bond, as it roughens the surface of the piece and substantially increases its surface area.



Incorrect angle to blast alloy surface

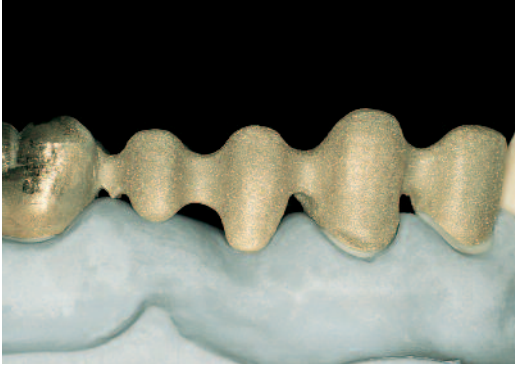
To prevent abrasive grit from becoming embedded in the alloy, we recommend blasting the alloy using the specified pressure and holding the jet nozzle at an angle.

A contaminated metal surface may cause bubbles to form in the ceramic during the firing process. Before any other work is done (application of ceramic or organic veneering material), the metal framework must be brushed under running water and cleaned with steam or in an ultrasonic bath.

**Use only pure  $\text{Al}_2\text{O}_3$  as disposable abrasive grit to blast alloy surfaces.**



# Oxidation



Drying after the cleaning process is important. Oxidize the framework according to the prescribed temperature and time (See alloy chart). Place the frameworks on the firing tray and provide adequate support. After oxidation, check the framework for porosity and irregularities in the oxide layer. Re-finish and reoxidize if necessary.



Depending on the type of alloy used, pickling or sandblasting of the oxide layer may be required after oxidation firing. (See Instructions for Use). Next, thoroughly clean the framework in an ultrasonic bath or steamer.

The oxidation firing establishes the optimum surface for porcelain bonding. Oxidation is considered to be a cleansing firing. It also allows the quality of the framework surface to be assessed.

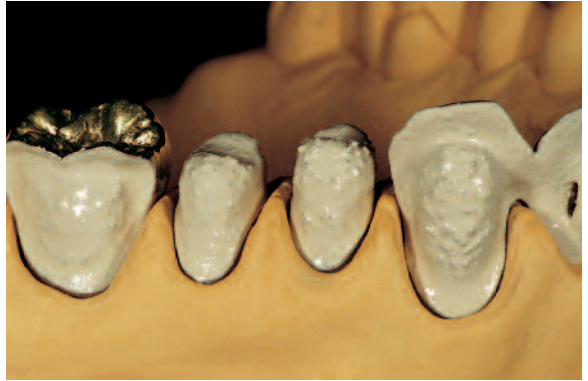
**The temperature accuracy of the ceramic furnace is important for all firings. Consequently, the furnace temperature must be regularly calibrated.**

**To prevent the temperature from exceeding the oxidation temperature, the ideal rate of temperature increase is 60 °C per minute.**

# Veneering

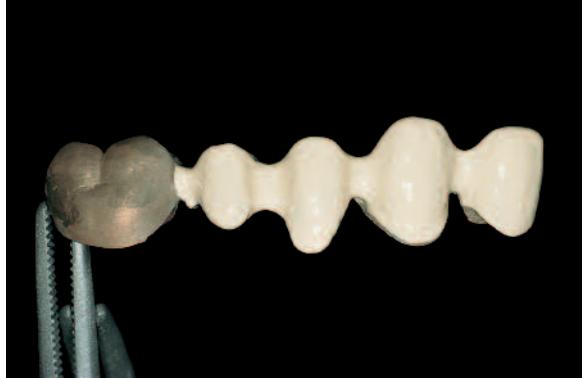
## Veneering with inorganic veneering materials

Prior to veneering the alloy surface, opaque it according to the directions of the manufacturer. The veneering procedure should be conducted according to the recommendations of the manufacturer.



## Veneering with ceramics

The processing instructions for the ceramic must be observed. The opaquer will cover the framework more successfully if it is applied in two layers. The initial coat should be applied thinly, while the second one should provide full coverage.



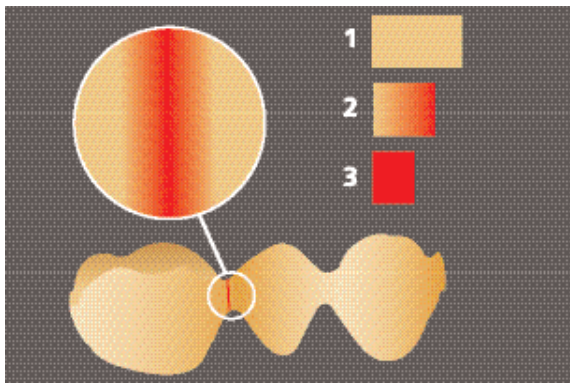
**To achieve a strong bond, the coefficient of thermal expansion (CTE) of the ceramic and metal must be compatible. The CTE of ceramic alloys is given in the alloy chart and the Instructions for Use of the different alloys.**

# Joining technique

Suggested alloy-solder combinations are shown in the alloy property chart. When the solder is selected, the difference between the soldering temperature and the solidus temperature of the alloy as well as the

firing temperature of the ceramic must be taken into consideration. A suitable fluxing agent should be used, depending on the melting temperature of the solder. The soldering surface should be clean

and adequately large for all the soldering joints. The surfaces must be enlarged for soldering applications in interdental areas. The ideal soldering gap should measure 0.05–0.2 mm.



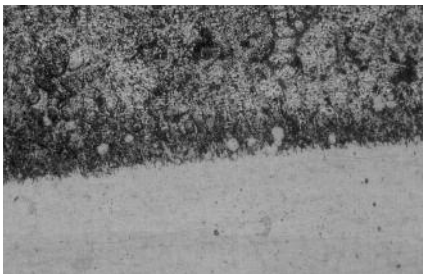
- 1 Alloy
- 2 Diffusion layer
- 3 Solder

## Presoldering (prior to ceramic application)

The soldering investment should be as small as possible. It is preheated in the furnace at max. 600 °C (base metal alloys max. 400 °C). The soldering site must be easily accessible to ensure even temperature distribution. The fluxing agent can be placed at this stage.

When using a propane-oxygen torch, the pressure of the oxygen should be set at 0.35 bar and that of natural gas at 0.15 bar. The reducing part of the flame should be used. Heat the solder and dip it in High Fusing Bondal Flux agent. Apply the fluxing agent on the connector surfaces. Heat the surface to be soldered with the torch

(neutral setting of the flame). Introduce the solder from the opposite side of the flame. The solder always flows to the hottest area. Once the joint is filled, remove the torch and allow the piece to cool.



SEM picture of a diffusion layer

# Joining technique

## Postsoldering in the furnace ( post ceramic application)

Cover ceramic surfaces with wax and invest as described. Remove wax with boiling water. Carefully apply Bondal Flux to the connector site. Do not allow the ceramic to come in contact with the fluxing agent. Heat

the tip of the solder and form a ball. This ball will be used as a reservoir when the soldering site is filled. Cut the solder approx. 4 mm from the ball and dip it into the fluxing agent. Place the solder on the soldering site and make sure that it touches the two joint surfaces. Slowly place the

soldering base in the ceramic furnace at 400 °C. Increase the temperature at a rate of 60 °C per minute until the melting point of the solder is reached. When the solder flows, remove the piece and allow it to cool.



## Laser welding

In the laser welding technique, an alloy with a similar composition to that of the crown and bridge frameworks is used to join these parts. Suitable laser welding wires are shown in the alloy property chart. Please follow the recommended welding parameters of the different equipment manufacturers during the laser welding process.



# Hardening / Removal of oxide layer / Polishing

## Hardening

Controlled heat treatment of an alloy can change its physical values. This process is not required for base metal alloys or alloys to which ceramic veneers are generally applied. The hardness of the alloy may have to be increased for telescope and conus crowns or customized attachments. The specifications for the heat treatment are provided in the alloy property chart and the different Instructions for Use.

## Removal of oxide layer

After soldering or heat treatment, the oxide layer must be thoroughly removed to ensure the corrosion resistance of the alloy.

Pickling is carried out to remove the oxide layer from the surface, which could affect gingival tissue. The recommendations of the different manufacturers regarding the concentration and duration of the process must be observed.



## Polishing

A polished surface offers optimal prerequisites for ensuring corrosion resistance. Polishing is carried out with rotary polishers. The direction of polishing should change constantly. The hardness of the alloy determines the pressure to be applied. Use a small amount of polishing paste on a rotary buffing disk to polish pieces to a high gloss. The direction of polishing should change constantly.

Generally, a good polish not only enhances the aesthetic appearance of the surface, it also improves the chemical resistance (e.g. lower susceptibility to corrosion).



# Note

## **Indication**

Alloys are specifically designed for different applications and approved for certain indications, based on their composition and the resulting physical properties.

## **Contraindication**

If the patient is known to be allergic or sensitive to any of the ingredients mentioned, an alternative alloy should be selected. In addition, a physician should be consulted.

## **Side effects**




In rare cases, sensitivity or an allergic reaction to the components of the alloy may occur.

## **Interaction**

Different types of alloys in the oral cavity may cause galvanic reactions.

## **Notes of safety**

In order to avoid any danger to health, alloys should be processed according to the safety regulations in force.

TYPE OF DEFECT	POSSIBLE CAUSES	CORRECTIVE ACTION
<b>Fit of casting too tight</b> 	<ul style="list-style-type: none"> <li>Improper investment mixing ratio</li> <li>Stored beyond the date of expiration</li> <li>Improper ratio of investment liquid to water</li> <li>Missing ring liner in the casting ring</li> <li>Burn-out temperature too low</li> </ul>	<ul style="list-style-type: none"> <li>Ensure th</li> <li>Do not s</li> <li>Increase</li> <li>Use ring</li> <li>Increase</li> </ul>
<b>Fit of casting too loose</b> 	<ul style="list-style-type: none"> <li>Improper investment mixing ratio</li> <li>Stored beyond the date of expiration</li> <li>Improper ratio of investment liquid to water</li> </ul>	<ul style="list-style-type: none"> <li>Ensure th</li> <li>Do not s</li> <li>Decrease</li> </ul>
<b>Incomplete casting</b> 	<ul style="list-style-type: none"> <li>Burn-out temperature too low</li> <li>Melting temperature too low</li> <li>Mould filled too slowly (weak casting machine spring)</li> <li>Patterns waxed too thin</li> <li>Wrong spruing technique</li> </ul>	<ul style="list-style-type: none"> <li>Increase</li> <li>Increase</li> <li>Ensure m</li> <li>Ensure p</li> <li>Ensure th</li> <li>located in</li> </ul>
<b>Hot tears</b> 	<ul style="list-style-type: none"> <li>Coarse or widely varying metal grain size</li> <li>Severely overheated alloy</li> <li>Thin cast section between thick sections</li> <li>Rapid cooling or quenching of alloy</li> <li>Excessive amount of alloy used (button too large)</li> <li>Improper placement of wax patterns in casting ring</li> </ul>	<ul style="list-style-type: none"> <li>Use a fin</li> <li>Ensure al</li> <li>Do not c</li> <li>Avoid rap</li> <li>Avoid cas</li> <li>Ensure th</li> <li>are locat</li> </ul>
<b>Casting fins</b> 	<ul style="list-style-type: none"> <li>Insufficient setting time for investment mould</li> <li>Investment heated too quickly</li> <li>Wax-patterns placed too close to top or sides of casting ring</li> <li>Wax-patterns too close together</li> </ul>	<ul style="list-style-type: none"> <li>Allow th</li> <li>Decrease</li> <li>Do not p</li> <li>Do not p</li> </ul>
<b>Rough surface</b> 	<ul style="list-style-type: none"> <li>Improperly mixed investment</li> <li>Usage of a non compatible investment/alloy combination</li> <li>Insufficient vacuum and / or time when mixing investment</li> <li>Casting temperature too high</li> <li>Excess surfactant (debubbler) on pattern surface</li> <li>Excessive vibration during investing</li> <li>Contamination of waxes and / or sprues</li> </ul>	<ul style="list-style-type: none"> <li>Ensure in</li> <li>Use only</li> <li>Ensure su</li> <li>Decrease</li> <li>Dry exces</li> <li>Avoid ex</li> <li>Do not u</li> </ul>
<b>Shrinkage porosity</b> 	<ul style="list-style-type: none"> <li>Length of sprues from wax pattern to reservoir too long</li> <li>Excessive amount of alloy used (button too large)</li> <li>Tapered sprues at point of connection to wax pattern</li> <li>Mould temperature too high and / or overheated alloy</li> <li>Improper reservoir or wax pattern location</li> </ul>	<ul style="list-style-type: none"> <li>Ensure le</li> <li>Avoid ca</li> <li>Do not ta</li> <li>Reduce n</li> <li>Ensure th</li> <li>located in</li> </ul>
<b>Gas porosity</b> 	<ul style="list-style-type: none"> <li>Oxygen inclusion from improperly adjusted torch</li> <li>Overheated alloy</li> <li>Turbulence in alloy when entering mould (Spruing Technique)</li> </ul>	<ul style="list-style-type: none"> <li>Adjust to</li> <li>Do not o</li> <li>Reduce t</li> </ul>
<b>Suck back porosity</b> 	<ul style="list-style-type: none"> <li>Excessive amount of alloy used (button too large)</li> <li>Improper reservoir, sprues and / or wax pattern location</li> </ul>	<ul style="list-style-type: none"> <li>Avoid ca</li> <li>Ensure th</li> <li>located in</li> </ul>
<b>Investment inclusion</b> 	<ul style="list-style-type: none"> <li>Excessive surfactant (debubbler)</li> <li>Sharp edges and corners at sprues / wax pattern junction</li> <li>Rough surfaces on the spruing system</li> <li>Investment breakdown</li> <li>Re-casting buttons contaminated with investment residue</li> </ul>	<ul style="list-style-type: none"> <li>Dry exces</li> <li>Remove</li> <li>Avoid ro</li> <li>Check m</li> <li>Do not r</li> </ul>

# Double-shooting chart

## CORRECTIONS

- the correct powder/liquid ratio is used
- store investment materials beyond the date of expiration
- the ratio of investment liquid to water
- liner when utilizing metal casting rings
- burn-out temperature
- the correct powder/liquid ratio is used
- store investment materials beyond the date of expiration
- the ratio of investment liquid to water
- burn-out temperature
- melting temperature of the alloy
- mould is not filled too slowly (replace weak casting spring)
- patterns are not waxed too thin
- the reservoir is located in the heat center of the ring and the patterns are in a cooler area
- use grained alloy and replenish at least 50% new alloy when recasting buttons
- alloy is not overheated
- cast an extremely thin section between two thick sections
- avoid cooling or quenching of alloy
- castings with large buttons (see wax conversion chart)
- the reservoir is located in the heat center of the ring and the patterns are in a cooler area
- the investment to fully set before burning out the mould
- the heating rate for the burnout furnace
- place wax-patterns too close to top or sides of casting ring
- place wax-patterns too close together
- investment is sufficiently mixed
- compatible investment / alloy combinations
- sufficient vacuum and / or time when mixing investment
- casting temperature
- use surfactant (debubbler) on pattern surface
- excessive vibration during investing
- use contaminated wax and / or sprues
- length of sprues from wax pattern to reservoir are not too long
- castings with large buttons (see wax conversion chart)
- separate sprues at point of connection to wax pattern
- mould temperature and / or alloy casting temperature
- the reservoir is located in the heat center of the ring and the patterns are in a cooler area
- stir properly to avoid oxygen inclusion
- overheat alloy during casting
- turbulence in alloy when entering mould (Spruing Technique)
- castings with large buttons (see wax conversion chart)
- the reservoir is located in the heat center of the ring and the patterns are in a cooler area
- use surfactant (debubbler) on pattern surface
- sharp edges and corners at sprues / wax pattern junction
- rough surfaces on the spruing system
- mould for investment breakdown
- re-cast buttons contaminated with investment residue

## TYPE OF DEFECT

## POSSIBLE CAUSES

**High-shine/polish not achieved**



- Improper polishing technique
- Porosity in casting

**Oxide layer too dark**



- Alloy contamination
- Improper finishing/blasting

**Oxide layer mottled**



- Alloy contamination
- Improper finishing/blasting

**Bubbles in opaque**



- Porosities in alloy substructure
- Rough alloy surface preparation
- Contaminated surface
- Failure to pickle specific alloys
- Pre-heating and / or drying time too short
- Pre-heating and / or drying temperature too high

**Bubbles in dentine**



- Porosities in alloy substructure
- Bubbles in opaque
- Incomplete sintering
- Insufficient vacuum
- Use of modelling liquid to re-wet ceramic
- Incorporation of air into ceramic material
- Pre-heating and / or drying time too short
- Pre-heating and / or drying temperature too high

**Cracking of ceramic material**



- Uneven thickness of ceramic material
- Incompatible coefficient of thermal expansion
- Improper cooling (thermal shock)
- Over or under firing of opaque and dentine
- Sharp edges on alloy surface

**De-bonding of ceramic from metal framework**



- Improper treatment and / or oxidation of metal framework
- Alloy surface contaminated
- Improper wetting of alloy with opaque

**Discoloration of ceramic material**



- Contaminated furnace muffle or furnace
- Use of silver containing alloys with ceramic

**Voids/porosity in solder joint**



- Solder overheated
- Excessive oxides during soldering
- Unequal temperature distribution
- Incorrect flux

**Solder did not fill connector**



- Insufficient solder and / or wrong alloy
- Solder gap is too narrow, too wide
- Excessive oxides during soldering
- Alloy contaminated
- Unit is covered with too much solder
- Unequal temperature distribution
- Incorrect flux



CAUSES

CORRECTIONS

Too short  
Temperature too high

Porcelain powders  
Materials  
Too short  
Temperature too high

Material  
Thermal expansion

Too thick / or dentine

Distortion of alloy surface

Too opaque

Firing tray  
Non-silver compatible ceramic materials

Too thin  
Too thick of the whole metal frame

Too little solder  
Too thick and / or too smooth

Too little solder investment  
Too thick of the whole metal frame

- Review proper polishing procedures
- Check for porosity in casting
- Check for alloy contamination
- Re-accomplish finishing/blasting procedures
- Check for alloy contamination
- Re-accomplish finishing/blasting procedures
- Check for porosities in alloy substructure
- Eliminate rough alloy surface preparation
- Check for contaminated alloy surface (do not touch porcelain bearing areas after oxidation)
- Ensure pickling is accomplished for specific alloys
- Increase pre-heating and / or drying time
- Decrease pre-heating and / or drying temperature
- Ensure the alloy substructure is free of porosity
- Ensure the opaque surface is free of bubbles
- Check firing parameters to ensure complete sintering
- Ensure sufficient vacuum during firing
- Use only water to re-wet porcelain powders (do not re-wet with modelling liquid)
- Avoid incorporation of air into ceramic materials
- Increase pre-heating and / or drying time
- Decrease pre-heating and / or drying temperature
- Design substructures to allow an even thickness of ceramic material
- Check alloy / ceramic for compatible coefficient of thermal expansion
- Ensure proper cooling to avoid thermal shock
- Avoid over or under firing of opaque and / or dentine
- Eliminate sharp edges when finishing alloy surface
- Ensure proper heat treatment and / or oxidation of alloy surface
- Check for contaminated alloy surface (do not touch porcelain bearing areas after oxidation)
- Ensure proper wetting of alloy with opaque
- De-contaminate furnace muffle and / or firing tray
- Do not use silver containing alloys with non-silver compatible ceramic materials
- Do not overheat solder
- Avoid excessive oxides during soldering (use reducing zone of flame)
- Preheat the solder assembly prior to soldering
- Use correct flux
- Use sufficient solder to fill joint
- Check solder gap for proper dimensions and surface finish
- Avoid excessive oxides during soldering (use reducing zone of flame)
- Blast connector area with 50 micron aluminum oxide prior to investing
- Do not cover unit with too much solder investment
- Preheat the solder assembly prior to soldering
- Use correct flux

# 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**

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

## **Ivoclar Vivadent Ltda.**

Rua Geraldo Flausino Gomes,  
78 – 6.º andar Cjs. 61/62  
Bairro: Brooklin Novo  
CEP: 04575-060 São Paulo – SP  
Brazil  
Tel. +5511 5102 2020  
Fax. +5511 5102 4704  
www.ivoclarvivadent.com

## **Ivoclar Vivadent Inc.**

2785 Skymark Avenue, Unit 1  
Mississauga  
Ontario L4W 4Y3  
Canada  
Tel. +1 905 238 5700  
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. 7-B-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. & C. s.a.s**

Via Gustav Flora, 32  
39025 Naturno (BZ)  
Italy  
Tel. +39 0473 67 01 11  
Fax +39 0473 66 77 80  
www.ivoclarvivadent.it

## **Ivoclar Vivadent K.K.**

1-28-24-4F Hongo  
Bunkyo-ku  
Tokyo 113-0033  
Japan  
Tel. +81 3 6903 3535  
Fax +81 3 5844 3657  
www.ivoclarvivadent.com

## **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) 5062-1029  
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.**

Derbenevskaja Nabereshnaja 11W  
115114 Moscow  
Russia  
Tel. +7495 913 66 16  
Fax +7495 913 66 15  
www.ivoclarvivadent.ru

## **Ivoclar Vivadent Marketing Ltd.**

180 Paya Lebar Road  
# 07-03 Yi Guang Building  
Singapore 409032  
Tel. 65-68469183  
Fax 65-68469192  
www.ivoclarvivadent.com

## **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 93 930  
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