Application Guide
Dental alloys for crowns and bridges.

Giving a hand to oral health.
Kulzer Dental Alloys:
Biocompatible – clinically tested – high quality.

Kulzer has decades of experience in manufacturing and developing alloys. During this time, the company has become one of the leading suppliers in this sector. Precious metal alloys are particularly suitable as framework materials for dental restorations, and they are the ideal material for veneering with ceramics and composites. Gold is the obvious choice for those looking for a high quality, durable dental restoration that has been time-tested for decades. Kulzer has a suitable alloy available for all indications.

- High gold content alloys for fusing with ceramics.
- High gold content casting alloys.
- Universal alloys.
- Reduced gold content alloys for fusing with ceramics.
- Reduced gold content casting alloys.
- Palladium-based alloys.
- Silver palladium-based alloys.
- Non-precious metal alloys for fusing with ceramics.
- Non-precious metal parture denture casting alloys.
- Non-precious metal universal alloy.

Kulzer Dental alloys and their advantages:
- Biocompatible and corrosion stable in the oral environment.
- Clinically tested for decades.
- Durable.
- Optimal for veneering with ceramics and composites.
- Low allergy risk.
- Easy to process.
- High strength.
- Precise fit.
- High reproducibility.

Decades of experience – One of seven good reasons to select Hera.

To make high-quality alloys really perfect the base must be right. And with Hera the base consists of seven particularly valuable reasons. Such as experience. Ultimately, Hera stands for Kulzer and thus for decades of competence. Whoever selects Hera is trusting an established specialist for highly aesthetic solutions for dentistry. An experienced partner who knows what is wanted.

www.Kulzer.com
Physical data of elements for dental applications

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Melting point [°C]</th>
<th>Density [g/cm³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>Au</td>
<td>1063</td>
<td>19.3</td>
</tr>
<tr>
<td>Silver</td>
<td>Ag</td>
<td>961</td>
<td>10.5</td>
</tr>
<tr>
<td>Platinum</td>
<td>Pt</td>
<td>1770</td>
<td>21.5</td>
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<tr>
<td>Palladium</td>
<td>Pd</td>
<td>1550</td>
<td>12.0</td>
</tr>
<tr>
<td>Copper</td>
<td>Cu</td>
<td>1080</td>
<td>8.9</td>
</tr>
<tr>
<td>Tin</td>
<td>Sn</td>
<td>230</td>
<td>7.3</td>
</tr>
<tr>
<td>Zinc</td>
<td>Zn</td>
<td>420</td>
<td>7.1</td>
</tr>
<tr>
<td>Indium</td>
<td>In</td>
<td>160</td>
<td>7.3</td>
</tr>
<tr>
<td>Niobium, Tungsten, Tantalum</td>
<td>Nb, W, Ta</td>
<td>2470, 3422, 3000</td>
<td>8.6, 19.3, 16.6</td>
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<tr>
<td>Indium, Rhodium, Ruthenium</td>
<td>In, Rh, Ru</td>
<td>2454, 1966, 2310</td>
<td>22.4, 12.4, 12.3</td>
</tr>
<tr>
<td>Manganese</td>
<td>Mn</td>
<td>1250</td>
<td>7.4</td>
</tr>
<tr>
<td>Iron</td>
<td>Fe</td>
<td>1540</td>
<td>7.9</td>
</tr>
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</table>
**Hera**

Physical data of elements for dental applications.

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Melting point [°C]</th>
<th>Density [g/cm³]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cerium:</strong></td>
<td>Ce</td>
<td>1071</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Gallium:</strong></td>
<td>Ga</td>
<td>29.8</td>
<td>6.9</td>
</tr>
<tr>
<td>Improves mechanical properties and increases the coefficient of thermal expansion. Lowers the melting range and optimises flowability. Colour: White.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cobalt:</strong></td>
<td>Co</td>
<td>1495</td>
<td>8.9</td>
</tr>
<tr>
<td>Is the basis for NPM parture denture casting alloys and NPM ceramic bonding alloys. Colour: White.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chromium:</strong></td>
<td>Cr</td>
<td>1857</td>
<td>7.14</td>
</tr>
<tr>
<td>Serves as an indispensable additive to cobalt and nickel base alloys, which only become corrosion-resistant with the addition of chromium. Colour: White.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Molybdenum:</strong></td>
<td>Mo</td>
<td>2623</td>
<td>10.21</td>
</tr>
<tr>
<td>Together with the chromium in cobalt- and nickel base alloys, provides for corrosion resistance and optimises the mechanical properties. Colour: White.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Silicon:</strong></td>
<td>Si</td>
<td>1410</td>
<td>2.33</td>
</tr>
<tr>
<td>Improves the castability of NPM alloys. Colour: Dark green.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbon:</strong></td>
<td>C</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Influences the tensile strength and the yield strength of NPM alloys.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nitrogen:</strong></td>
<td>N</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Promotes the corrosion resistance, strength and toughness of cobalt-chromium base alloys at the same time.</td>
<td></td>
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</tr>
</tbody>
</table>
Melting range:
Describes the temperature range in which alloys passing the phase change from solid to liquid. Alloys require a temperature range in which they slowly change phase from the liquid, to the viscous, and then to the increasingly solid phase. This range is bordered by the solidus point and the liquidus point. Below the solidus temperature, the alloy is solid, and it is liquid above the liquidus temperature. It is neither a solid nor a liquid in between the two temperatures.

Hardness:
In materials testing, hardness describes the resistance of one object against the intrusion of another, harder object; the higher the resistance, the greater the hardness. In dental technology, the Vickers hardness test is used most frequently. The Vickers hardness test uses a diamond square-based pyramid with an angle of 136° between opposite faces. The pyramid is perpendicularly impressed into the probe at a defined load, e.g. 5 kp (HV5). The diagonals of indentation are measured, and their average and the resulting surface of the indentation are calculated. The hardness associated with the diagonals of indentation is found in the hardness comparison tables of EN ISO 6507-1.

Yield strength:
The 0.2 % yield strength is the tension required to cause the tested object to permanently stretch by 0.2 %. The higher the values (in MPa), the more force must be applied to permanently deform a restoration. For dental alloys, the 0.2 % yield strength must have a minimum value as identified in the standard DIN EN ISO 22674. Together with the elongation at fracture, this value allows a classification of materials into types (Type 0 to Type 5).

Elongation:
Is the breaking limit in which a test bar fracturing in the tensile testing machine under force. Elongation at fracture is the relationship between the initial length and the total deformation at the time of fracture. The Elongation is indicated in percent. Lower elongation at fracture indicates that the alloy is brittle, higher elongation at rupture characterises a ductile, highly expansible material. Higher values correspond to better finishing properties of the alloy.

Density:
The density of an alloy is the ratio of its mass to its volume. In casting technology, the amount of material needed can be calculated from the mass of the wax pattern, the density of the wax and the density of the metal.

\[
\text{Density} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}}
\]

Coefficient of thermal expansion (CTE):
Every material has a characteristic coefficient of thermal expansion in its solid and liquid state. The thermal expansion of solid and liquid materials is linear in a first approximation. The CTE is a material constant that indicates how much the material changes in volume when its temperature changes. It is advantageous if the CTE of the ceramic is lower than that of the alloy, so that the necessary compressive stress builds up during cooling. The CTE of the ceramic and the alloy to be veneered should be optimally matched to avoid cracking and spalling.

Young’s modul:
The young’s modulus is a material property which is a characteristic value, as are hardness and density. The young’s modul is a measure of the resistance of a material against elastic deformation; it indicates the stiffness of a material. The greater the young’s modul, the more force is needed to deform the material.
Hera
Model fabrication.

Models for inlays, crowns and bridges must be created in view of functional, anatomic and aesthetic aspects. Crown copings can be prepared using thermoforming sheets, modelling plastics or dipping wax. For crowns and parts of bridges that are veneered with composites, the model must include adequate retentions and a minimally visible incisal edge protection. Miniaturised anatomic shapes should be modelled to prepare crowns and pontics that will be veneered with ceramics. The wall of the model should not be less than 0.4 mm in thickness, so that the minimum thickness in the metal will be 0.3 to 0.35 mm.

Ensure that the approximal connectors in the model are sufficiently stable (at least 9 mm² cross-section). In long bridges, the palatal / lingual area of the pontics should feature an interdental reinforcement in the form of a garland or statically optimised reinforcement similar to an inlay in the interdental space. This particularly applies to Pd-free, high gold content metal-ceramic alloys and Pd-free universal alloys.

In precious metal implant suprastructures, a sufficiently thick wax layer (at least 0.4 mm) must be applied to the implant coping to avoid spalling of the ceramic resulting from differences in the CTE. The implant manufacturer's recommendations must be observed. Again, particularly stable framework construction is required.
Modelling materials (wax and plastic)

The high plasticity of waxes and the resulting risk of deformation of wax objects have led to the development of modelling plastics that are cured by light or autopolymerisation after the model is created. Models produced in this manner feature high mechanical stability, thus reducing the risk of deformation.

- A disadvantage is that many of these plastics initially expand during the heating process in the casting mould. As a result, parts of the surrounding investment materials may be destroyed. To prevent this behaviour, the use of robust investment materials and partial coating with wax are required.

To avoid potential defects caused by expansion, Kulzer has developed plastics that shrink during the preheating process in the casting mould (e.g. Palavit G). In casting moulds with plastic models, the preheating program must be modified in such a way that the firing is as residue-free as possible, e.g. through heating to the maximum allowable preheating temperature of the investment material and subsequent reduction of the preheating temperature to the allospecific preheating temperature. Increasing the holding time at 580 °C (2nd holding temperature) and at the final temperature also contributes to reduced residue when firing modelling plastics.
Hera
Attaching sprues, sprue diameter and geometry.

For gold casting alloys, metal-ceramic alloys, universal alloys and non-precious metal-ceramic alloys.

Sprue design for bridges
We recommend using a reservoir bar sprue system for bridgework. The feeder sprues are applied palatally or lingually to each pontic at a 45° angle (use two feeder sprues in case of large molar crowns or large pontics). The feeder sprues are connected by a horizontal bar sprue. The sprues extending from the funnel to the horizontal bar sprue are placed approximately between the first and second third and between the second and last third of the horizontal bar sprue. The horizontal bar sprue must be located somewhat outside of the centre of the muffle at half of the height of the muffle (the distance between the horizontal bar sprue and the bottom of the casting mould is 27.5 mm). The various cast units should be at the same distance to the wall of the casting ring to ensure equal cooling conditions.

Feeder sprues 5.0 mm in length and 3.5 mm in diameter are attached to the palatal or lingual surfaces of the wax patterns at an angle of 45°. The feeder sprues are connected by a 5.0 mm diameter horizontal bar sprue. The sprues leading from the funnel to the horizontal bar sprue are also 5.0 mm in diameter.

Feeder sprues 3.5 – 4.0 mm in length and 2.5 mm in diameter are attached to the palatal or lingual surfaces of the wax patterns at an angle of 45°. The feeder sprues are connected by a 3.5 mm diameter horizontal bar sprue. The sprues leading from the funnel to the horizontal bar sprue are also 3.5 mm in diameter.

Feeder sprues 4.0 mm in length and 3.0 mm in diameter are attached to the palatal or lingual surfaces of the wax patterns at an angle of 45°. The feeder sprues are connected by a 4.0 mm diameter horizontal bar sprue. The sprues leading from the funnel to the horizontal bar sprue are also 4.0 mm in diameter.
Sprue design in single unit sprueing

Single crowns, inlays and onlays can be sprued directly. The sprues are 4.0 mm in diameter and must be attached to the cast units without taper.

If two or three bridge models are placed onto one funnel former, they must be arranged in a circle at equal distances to the wall of the casting ring.

Correct and incorrect position of several bridges in the casting mould.
**Hera**

Casting large units / Required alloy amount.

How are large-volume units 10 – 12 mm in diameter cast without bubbles?
The illustration shows differences between a conventional, “normal” restoration, which is still valid for all pontics, and the version for extremely large pontics with diameters greater than 10 – 12 mm. The illustrated sprueing must only be used when casting extremely large units.

**Casting extremely large units**
The sprue diameter of 5 mm for the horizontal bar sprue and the connection to the funnel former as well as the 3.5 mm diameter for the feeder to the object remain unchanged. However, the distance between the horizontal bar sprue and the object is increased to 10 mm. In addition, the area where the feeder sprues attach to the horizontal bar sprue is increased to 5 mm in extremely large units. The position of the horizontal bar sprue remains unchanged at half of the muffle height.

**Calculating the required alloy amount and reusability of casting cones**
Prior to waxing up the cast unit on the funnel former, the amount of alloy required for casting must be calculated. The sprued wax framework is weighed with the sprues in place.

The required amount of alloy is calculated by multiplying the mass of the wax model by the density of the alloy used and dividing by the density of the wax (on average 0.93 g/cm³).

The “Wax to alloy mass” conversion table, which is part of the actual Technical Data Table, is an excellent aid in this regard. When using vacuum pressure casting, no additional alloy material is needed for the casting cone.

Any precious metal sprues can be reused after careful cleaning and the addition of new alloy. They are cleaned by blasting off with corundum (Al₂O₃), then cleaning under water and drying. When using recovered materials, the mixing ratio is a maximum of 2/3 used material to at least 1/3 new material (same manufacturer and trade name).

It is recommended not to recast non-precious metal ceramic bonding alloys for the indication ceramic veneering. Please find detailed information on recastability in the respective instructions for use of the non-precious metal alloy.
Waxing up on the funnel former

The finished wax models should only be placed onto funnel formers that are compatible with the casting machines used. The Kulzer funnel formers are designed such that the casting funnel is not too high, so that an adequate sprue can be attached. In addition, they ensure loss-free flow of the molten metal. This applies both to ring-free investment and to investment with steel ring and fleece liner. A thin layer of Vaseline is applied to the funnel formers prior to waxing up the wax model, so that they can be more easily removed after investment.

The wax model is waxed up in such a way that the horizontal bar sprue is placed horizontally somewhat outside of the muffle centre at half of the height of the sprue, and the casts are placed closer to the wall of the casting ring. The placement is significantly facilitated by the mentioned sprueing aid. The sprues are connected with the funnel former using wax and ensuring smooth transitions.

Suitable investment materials

We recommend using phosphate-bound, graphite-free investment materials by Kulzer for all precious metal dental alloys and for non-precious metals. These investment materials are graphite-free and can be used without safety concerns. For more detailed information on the investment materials, please refer to the instructions for use for our investment materials.

When casting metal-ceramic alloys with high palladium content, do not use graphite-containing, phosphate-bound investment materials.

The recommended crucible material for each alloy found in the actual Technical Data Table also identifies the investment material to be used. Alloys that are exclusively melted in the ceramic crucible must not be cast in graphite-containing investment materials.

⚠️ Please observe the instructions for use that are enclosed with the respective investment materials. They include information about intermediate temperatures, heating rates and holding times.
Preheating of the casting mould.

Uniform preheating of the casting mould is an important requirement for achieving a well-fitted dental cast. Therefore, the heat-related design of the preheating furnaces is very important. In practice, the useable space of preheating furnaces is heated from four, three or two sides. The advantages and disadvantages of the different furnace designs are evaluated in view of the heat transfer to the casting mould.

The figure on the right shows a diagram of the cross-section through the useable space of a preheating furnace that is heated from four sides and that additionally features a fan. Heat is transferred by the conduction of heat through the tray, the circulation of warm air (convection) and thermal radiation by the four heated walls of the useable space. An additional fan improves convection in furnaces heated from four sides that have more than 3 litres of useable space. Above approximately 600 °C, thermal radiation has the principal effect. In addition, the heating elements should be covered with ceramic to achieve uniform radiation of energy from the walls of the useable space and therefore uniform heating of the casting mould. Furnaces heated from four sides feature the largest proportion of space that is at nearly the same temperature. Casting moulds can be preheated in furnaces heated from four sides with either the program-controlled or the transfer technique.

Therefore, the preheating furnace heated from four sides provides optimal heating.

For the preheating temperature, please refer to the current actual Technical Data Table, to the enclosed alloy information sheet for precious metal alloys and to the enclosed instructions for use for non-precious metal alloys.
Crucible materials, melting and casting.

Graphite crucible
Metal-ceramic alloys with high gold content can be melted in a graphite crucible or, when using inductively heated casting machines, in a ceramic crucible with graphite insert. They are melted in Kulzer graphite crucibles. These crucibles are durable and free of any additives that may damage alloys.

Ceramic crucibles
Pd-based alloys and some metal-ceramic alloys with reduced gold content must be melted in ceramic crucibles. This is necessary because such alloys absorb carbon during melting, which negatively influences mechanical properties, and bubbles can form when the ceramic is applied. Therefore, they must not touch carbon during melting or casting. These alloys should be melted in ceramic crucibles made by Kulzer. These crucibles consist of a balanced mix of various natural clays that withstand the high melting temperatures of these alloys and do not release substances that may damage alloys. Kulzer ceramic crucibles are available for all Kulzer casting machines. Separate crucibles must be used to melt the different alloys.

Ceramic crucibles for inductively heated casting machines
Special non-precious metal ceramic crucibles with increased durability are available for non-precious metal alloys. For the proper crucible type, please refer to the current Technical Data Table or to the instructions for use for the respective non-precious metal.

Suitable casting machines and melting methods
We recommend melting and casting in temperature-controlled resistance-heated vacuum pressure casting units (e.g. CL-G 97, CL-G 94, Heracast RC) or in inductively heated vacuum pressure casting units (e.g. CL-Ig, CL-I 95, Heracast iQ and Heracast EC).

In contrast to flame melting, these casting machines ensure that the alloys are gently melted and not overheated. Selection of the correct crucible material further ensures that the alloy cannot absorb components that may damage the alloy.

The instructions for use of the employed casting machines must be observed when casting the alloys. This applies to resistance-heated and inductively heated casting machines as well as those heating with electrical arc or open flame.

After casting, the casting mould is removed from the casting machine and cooled to room temperature. The casting mould must not be cooled in water.

For casting temperature and melting range, please refer to the current Kulzer technical data sheet of dental alloys or to the enclosed instructions for use for non-precious metal alloys.
Deflasking and cleaning the cast units / Tempering after casting with Hera.

**Mechanical removal of the investment compound**
When using flasks, the casting moulds are first pushed out of the flasks after cooling to room temperature. Then, the cast units are carefully removed from the investment compound using plaster nippers. Do not deflask the cast units using a hammer, since this may cause deformation and stress.

**Blasting**
After mechanical deflasking, the remnants of the investment compound are blasted off with 50 μm or 125 μm blasting corundum (Al₂O₃) using a precision blasting unit.

*Especially the softer, Pd-free alloys are blasted with blasting corundum (Al₂O₃) at pressures no higher than 2 bar.*

*Ensure effective extraction of respirable dust. Please wear a suitable respirator mask Typ FFP3-EN 149-2001.*

**Tempering through additional heat treatment**
Almost all precious metal alloys, such as metal-ceramic, universal and gold casting alloys, can be additionally tempered by another heat treatment for various reasons, e.g. after soldering or for better cutting properties during reaming. In metal-ceramic and universal alloys, tempering can be performed after the last firing. This increases hardness and improves the yield strength and stiffness in bridges. Non-precious metal alloys cannot be quenched and tempered!

*Different alloy types reach maximum hardness at different dwell times and temperatures. Please refer to the current Technical Data Table for times and temperatures.*

Example: Tempering behaviour of precious metal dental alloys.
Surface treatment – Trimming.

Trimming metal-ceramic alloys, gold casting alloys and universal alloys

An optimal metal-ceramic bond is ensured by trimming with cross-cut tungsten carbide cutters with phase cut or fine tungsten carbide cutters.

Suitable trimming tools for dental alloys.

Trimming of reduced gold metal-ceramic alloys as well as Pd-based metal-ceramic alloys

Absolutely avoid contact with carbon and carbon-containing substances because of the risk of bubble formation during ceramic firing. Therefore, diamond trimming tools must be avoided.

If carbon residue is still found on the surface of the framework (e.g. fat residue from finger prints, oil deposited when blasting with unclean compressed air), it must be thoroughly steamed off.

Trimming non-precious metal alloys

The use of stone grinding wheels may cause contamination on the surface of the framework. To avoid bubble formation later on during ceramic firing, Kulzer again recommends cross-cut tungsten carbide cutters.
Preparing the framework surface for ceramic veneering and composite veneering

Preparing for composite veneering.

Sandblast the surface to be veneered with at least 110 μm blasting corundum (Al₂O₃) and a pressure of 3 bar (single use blasting agent). Pd-free metal-ceramic alloys with high gold content can only withstand pressures of 2–2.5 bar and must be blast at an obtuse angle. Afterward, clean with clean compressed air (oil-free) or clean tap water (no steam jet) and thoroughly dry. Place a sufficient amount of Signum metal bond 1 into the dish and apply to the proper surface using a fine brush, then allow to air dry. Apply a second layer if necessary.

Shake Signum metal bond II several times to achieve optimal distribution of the colour pigments on the surface. Evenly apply Signum metal bond II 1–2 times using another brush. Finally, polymerise for 90 seconds using HiLite power. To achieve optimal adhesion, the required opaquer and then the composite must be applied without contamination caused by contact or a lengthy pause.

Preparing for ceramic veneering.

Ceramic veneering requires that the trimmed metal framework is blast off using blasting corundum (110 μm–125 μm aluminium oxide Al₂O₃). The soft high gold content, Pd-free alloys must be blast at a pressure of only 2–2.5 bar at an obtuse angle to prevent corundum particles from penetrating the surface of the framework. Harder Pd-containing alloys are blast off at pressures between 3 and 3.5 bar.

Cleaning the surface of the framework for ceramic veneering.

After blasting off with blasting corundum (Al₂O₃), the framework is cleaned and degreased. The best cleaning and degreasing results are achieved when using the steam jet cleaner. However, cleaning under running water and subsequent boiling in distilled water is also sufficient. After cleaning, the framework must not be touched with bare hands but only with cleaned forceps or clamps.

Oxide firing before ceramic veneering.

Temperature and duration of oxide firing vary depending on the alloy. In addition, some alloys are not heated in air but under vacuum to achieve uniform oxidation. The oxide firing also provides information about the purity of the surface. The oxide colour must be even and free of spots. If spots are found, the framework must once more undergo blasting off with blasting corundum (Al₂O₃), cleaning and oxide firing.
Oxide firing.

Oxide firing of high gold content, reduced-gold and Pd-based metal-ceramic alloys:
■ When using HeraCeram ceramics, oxide firing takes place at 880°C.

Oxide firing of universal alloys / HeraSun alloys: Oxide firing of universal alloys | HeraSun alloys:
■ When using HeraCeramSun ceramics, oxide firing takes place at 800°C.

Oxide annealing of NPM ceramic bonding alloys:
■ Oxide annealing is not required when using HeraCeram NP-Primer or HeraCeram Pre-Opaque/HeraCeram Sun Pre-Opaque. Otherwise oxide annealing is performed for 10 min. at 950°C

During oxide firing, select a slow heating rate to avoid overshooting the furnace temperature. This increases the dimensional accuracy of the framework (reduced distortion tendency).

⚠️ We highly recommend adequately and safely supporting the framework on the firing tray. When using other ceramics, please follow the manufacturer’s instructions.

Oxide treatment after oxide firing (pickling/blasting off).

Oxide treatment in Pd-containing metal-ceramic alloys and non precious metal alloys:
■ Since the oxide layer extends deeper into the alloy than in high-gold content, Pd-free metal-ceramic alloys, the relatively dark oxide must be removed again by blasting with blasting corundum (Al2O3 110 µm – 125 µm) after oxide firing. The proper blasting pressure is determined by the alloy.
■ NPM ceramic bonding alloys often display pronounced oxide formation, which can adversely affect the bond between the alloy and ceramic. For this reason, the oxide layer has to be removed after oxide annealing by blasting with corundum (Al2O3 110 – 125 µm).
■ The blasting pressure must be adapted according to the alloy.

Afterward, very carefully steam off the framework to remove remnants of the blasting material.

Oxide treatment in Pd-free metal-ceramic alloys and universal alloys / HeraSun alloys:
■ Pickle the oxides using Hera AM 99. Prepare a separate pickling bath for pickling after oxide firing. Do not perform this step in a bath used for other purposes, such as for removal of oxides and flux remnants after soldering.

Afterward, steam off the framework very carefully to remove any remaining acid.
Hera
Blendgold Neu and ceramic firing.

Blendgold
Blendgold Neu precious metal paste consisting of pure gold, an organic liquid and ceramic particles. Blendgold Neu serves to increase the metal-ceramic adhesion and is applied to the surfaces to be veneered before ceramic firing. In addition, it optimises the colour below the ceramic. Please refer to the package insert for detailed instructions for use. This also provides detailed information as well as the special features / restrictions on non-precious metal alloys.

Ceramic firing
For veneering using HeraCeram or HeraCeramSun, use the values listed in the tables of the current instructions for use for HeraCeram and HeraCeramSun.

When veneering with other conventional ceramics, use the firing parameters as indicated by the respective ceramic manufacturer.

Cooling after ceramic firing
- When using HeraCeram and HeraCeramSun ceramics, slow cooling after ceramic firing is not required if the framework is designed properly.

Since the coefficients of thermal expansion and the resulting thermal expansion curves of the alloy and various veneering ceramics always differ to a certain degree, tension may arise in the metal-ceramic bond during cooling following the firing; these may lead to spalling of the ceramic.

- However, proper cooling rates after firing can achieve more similar thermal expansion curves, i.e. more uniform cooling of the two materials. Ideally, the ceramic is exposed to slight compressive stress in the final state after cooling.

⚠️ Please comply with the cooling requirements as stated in the manufacturer’s instructions for use if you are using ceramics made by other manufacturers.

⚠️ In case of larger bridges, ensure good support on the firing tray by using support pins in each individual abutment crown.

Correctly supported bridge on firing tray.
Soldering – Preparing the soldering gap/soldering.

Preparing the soldering gap
For soldering, all surfaces making up the soldering gap must be sufficiently large, cleaned, exhibit a polished metal surface and be parallel to one another. The surfaces should be rough. Surfaces that are too coarse increase the risk of gas bubble formation in the soldered joint. Optimal surface roughness is achieved by using fine-cut tungsten carbide cutters or by blasting with 50 μm blasting corundum (Al2O3). Soldering gaps with uneven width or V-shape as well as excessively large soldering gaps may cause the solder to solidify while forming bubbles. The width of the soldering gap should be between 0.05 mm and 0.2 mm.

- Fill wider soldering gaps with disks prepared from separated sprues of the corresponding alloy.

Soldering that is planned based on the design should already be prepared accordingly during modelling of the crowns or bridge frameworks.

Preparing the soldering
The soldering block made from soldering investment should be as low in mass as possible. Ensure complete drying and uniform preheating of the soldering block prior to soldering.

Correctly sized soldering block.
Hera
Recommended solder.

We recommend exclusively using dental solder made by Kulzer. The chemical composition and working temperature of these solders is adapted to our alloys. Please refer to the current Technical Data Table to determine which solder is best suited for each alloy.

- When soldering precious metal alloys to a partial denture framework made from a CoCr-based alloy, you can directly solder using Stahlgold Lot 750 solder. When using other solders, Stahlgold Lot 910 solder must be applied to the partial denture framework first. When soldering non-precious metal alloys to a partial denture framework made from CoCr-based partial denture alloy, use Stahlgold Lot 910 solder. Heraenium P Lot 1 is available to solder the non-precious metal ceramic bonding alloys Heraenium P and Heraenium Pw prior to ceramic firing. Heraenium Sun Lot 1 is used for soldering the non-precious metal universal alloy Heraenium Sun prior to ceramic firing.

- When soldering high palladium-content metal-ceramic alloys and Pd-based metal-ceramic alloys to CoCr-based partial denture framework works, first apply Herador Lot 1060 solder to the metal-ceramic alloy. Then using Stahlgold Lot 750 solder.

- If soldering is to be performed on palladium-containing metal-ceramic alloys and Pd-based metal-ceramic alloys after firing, Herador Lot 1100 or 1060 solder must be applied prior to firing, and furnace brazing must be performed using solders with working temperatures around 800°C.

- Herador Lot V 800 solder is processed in vacuum during furnace brazing.

⚠️ Stahlgold Lot 910 solder contains nickel!
Flux, soldering procedure and pickling.

**Recommended flux**
- Soldering precious metal to precious metal: Hera UL 99
- Soldering precious metal to non-precious metal: Hera SLP 99
- Soldering non-precious metal to non-precious metal: Hera SLP 99

**Soldering procedure**
- Soldering prior to firing is normally performed using an open flame. Particularly when performing initial soldering on bridge frameworks made from yellow, high gold content dental alloys, absolutely avoid overheating the framework, since it can otherwise deform or begin to melt.
- Soldering after the ceramic firing (second soldering) should preferentially be performed in the ceramic firing furnace to avoid spalling of the ceramic.
- For soldering after ceramic firing, observe the different cooling rates of the alloys (like in ceramic firing).

**Pickling of the soldered units**
We recommend the pickling agent Hera AM 99 for pickling off the oxides and flux remnants from precious metal alloys.

Mix a solution for use with approximately 65g of powder and 250ml of warm water. Warm it and submerge the soldered unit using nonmetallic forceps. After oxides and flux remnants are dissolved, carefully rinse the units with water.

Please observe the safety instructions on handling acids.

Pickling agents can attack ceramic veneers. Therefore, observe the manufacturer’s instructions for use (including those on pickling time)!
Laser welding offers significant advantages to soldering. If parts made from the same alloy are welded together, the joints are more corrosion resistant and therefore more bio compatible than those in soldered units. Laser welding wire (Ø 0.5 mm / Ø 0.3 mm or Ø 0.35 mm) of identical composition is available for almost all dental alloys. In the few cases where the wire cannot be manufactured for technical reasons, a similar alloy can be recommended.

Laser welding can also take place in the immediate vicinity of ceramic and composite veneers or denture saddles due to the very small size of the heat-affected zone near the weld point or weld seam. The placement of the parts to be joined by welding is generally identified on the master model. Usually, the parts to be joined by laser weld points can be held in correct position using the fingers. The time-consuming preparation of a soldering block, the soldering procedure and post-processing of the entire unit are no longer necessary. In addition, the high pulse frequency of the powerful laser welding device significantly reduces work time. If there is a proper weld seam, the risk of deformation can be reduced to a minimum.

Please ensure proper inert gas shielding of the welding area!
Final treatment.

Pickling of the crown margins in finished restorations
Oxide remnants at the crown margins of ceramic veneered restorations may cause irritation of the gums.

To increase patient safety, pickling finished precious metal restorations is generally recommended for the removal of oxide remnants. For this purpose, the restoration is pickled in Hera AM 99.

Polishing
Polish according to the hardness of the respective alloy to achieve a smooth, shiny surface. Adjust the polishing pressure based on the softness of the alloy. Constantly alter the polishing direction of the polishing wheel. Use little polishing agent during high-lustre polishing with rotating leather, linen, canvas and wool buff wheels. Clean the unit prior to each change in the polishing agent. When using the same polishing agent, cleaning prior to changing the polishing wheel is not necessary.

NPM alloys can be polished effectively using polishing brushes with hard black bristles (e.g. Chungking), NPM polishing paste and high speed polishing. Leather buffs are also well suited for high-gloss polishing.

High-lustre polishing of soft alloys
Pre-polish soft alloys using a rubber polisher until the polishing surfaces are free of surface irregularities. Afterward, polish using soft goat hair brushes in the handpiece, at low speeds (5000 rpm) and low pressure and with a small amount of Hera GPP 99 gold polishing paste. Then, remove the last remnants of the applied paste using a wool buff wheel.

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HeraCeram – The innovative veneering system for your crowns and bridges

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Optically perfect, technically perfect – for results that you and your patients can see.

Find out more about HeraCeram www.kulzer.com/heraceram.