General Processing Notes

Casting and Ceramic Alloys and Alloys for Low-Fusing Ceramics

C.HAFNER

FOR DENTAL EXCELLENCE

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Dear Colleagues:

On the following pages we would like to offer you some tips and tricks for working with our casting and ceramic alloys and our alloys for low-fusing ceramics.

We are sure you will find that C. HAFNER quality products will give you outstanding results.

WAX UP

Follow the generally acknowledged rules of dental technology in waxing up the restoration.

In the case of resin veneers, provide sufficient retention elements (beads, wires or indvidual undercuts) on the surfaces to be veneered. For pretreatment and veneering, follow the recommendations given by the resin manufacturers.

In the case of ceramic veneers, the sculpting of the wax pattern to be veneered should approximately follow - albeit at reduced size - the anatomic shape of the planned final restoration. The metal side of the metal/ceramic margin should be chamfered. In metalloceramic restorations, do not create any sharp edges, pointed angles, deep grooves, or undercuts. The thickness of the wax copings, i.e. the thickness of the metal framework to be cast, should be 0,3 to 0,5 mm after finishing, depending on whether the crown will be a single crown or an abutment crown.

Design the sprue system according to the following rules, using cylindrical sprues:

- Use single sprues 3 to 4 mm diameter
- Affix the sprue, without any constrictions or bulges, to the most voluminous area of the casting
- Design connecting angles so that the melt can reach the most remote parts of the casting without any abrupt changes in direction
- For long-span bridges use a bar technique: Install a crossbar 4 to 5 mm in diameter as a melt reservoir and provide each pontic pattern with its own supply sprue, 2.5 mm in diameter and 3 mm in length
- Interdental spaces and massive pontics are to be provided with vents or a ribbed heat sink (1 mm in diameter)

Determine the amount of alloy needed for casting according to the weight of the wax pattern (see „Wax Conversion Table“ in our Dental Information on casting alloys).

INVESTING

Mix the investment compound and invest the wax pattern following the instructuions given by the investment manufacturer.

Position the pattern outside the thermal center, as close as possible to the bottom of the casting ring, while still preserving the minimum thickness of investment between the casting and the walls of the casting ring, as recommended by the investment manufacturer.

One formed fabric insert should be used for metal casting rings of sizes 1 and 3, while two inserts should be used for sizes 6 and 9. Should these recommendations be at variance with those given by the investment manufacturer, the latter should prevail.

Setting or drying times vary by investment type. Follow manufacturer’s recommendations.

Use only phosphate-bonded investments for high-fusing ceramic alloys.
Use only graphite-free, phosphate-bonded investments for palladium-based alloys.

BURNOUT AND PRE-HEATING

The temperatures and times required for burnout and pre-heating will depend on the size of the casting ring, the number of casting rings in the burnout furnace, the investment used, and the alloy in which the patterns will be cast.

Times required for burnout at 300 °C, depending on the size of the casting ring:

1 x 20 minutes	3 x 30 minutes
6 x 45 minutes	9 x 60 minutes

Times required for pre-heating at the required pre-heating temperature (see „Pre-heating temperature“ in our Dental Information on casting alloys) depending on the size of the casting ring:

1 x 20 minutes	3 x 30 minutes
6 x 45 minutes	9 x 60 minutes

We recommend burning out the wax immediately after the investment has set. While the investment is still moist, it prevents to a significant extent the entry of liquid wax and promotes complete burnout. Incompletely eliminated wax will adversely affect the quality of the resulting casting.

Should these recommandations (with the exception of the alloy-specific pre-heating temperature) be at variance with those given by the investment manufacturer, the latter should prevail.

MELTING AND CASTING

Our alloys can be heated in resistance heated or inductively heated furnaces or with an open propane/oxygen flame. The casting processes recommended are centrifugal casting or vacuum/pressure casting.

For open-flame casting, the alloy should be melted in the reducing area of the flame which has been set to normal. To determine the correct propane and oxygen pressures, follow the equipment manufacturer’s recommendations. The use of a multiple-orifice tip is recommended.

For centrifugal casting, the correct position of the pattern within the casting ring is of vital importance. The pattern should be positioned in the direction opposite to the rotational motion of the casting machine, so that centrifugal forces drive the melt into the most remote aspects of the casting.

Casting parameters are specific to each casting alloy and to the casting method used (see „Heating times after melting“ in our Dental Information on casting alloys). We recommend the use of ceramic crucibles for palladium-based alloys and of graphite crucibles for all other alloys. Any exceptions are mentioned in the „Special Processing Notes“ in the information leaflets on the individual alloys. It is recommended to utilize a separate crucible for each alloy.

Before reusing casting residues, this material should remelted and cleaned very carefully.
The percentage of unused material should be at least 50 %.

DIVESTING AND CLEANING

Allow casting ring to cool to room temperature after casting. Immerse casting ring in water to minimize dust formation during divesting. Do not use a hammer. Rinse alloy under running water, pickle (10 % sulfuric acid or commercial pickling acid) and/or sandblast (using pure alumina, 50 - 110 µm in diameter, 200 kPa (2 bar) pressure).

TRIMMING AND FINISHING

For finishing, use a square, crosshatched tungsten carbide burs, sintered diamond burs, or medium-grained ceramic burs. Use only clean instruments for grinding. Take care to ensure always to use the same direction of rotation, that the rotation speed is moderate, and that the pressure exerted is low. This will help avoid overlaps to a large extent. Eliminate all errors such as porosities or enclosures.

Sandblast the area to be veneered with a one-way sandblaster (using pure alumina, 50 - 110 µm in diameter, 200 kPa (2 bar) pressure). Boil out framework in deionized water or with a steam cleaner. Do not touch framework with your fingers after this step.

OXIDIZING

Oxidizing is performed at the temperature of the opaquer firing at normal atmospherie pressure for five minutes. When finished, clean the framework with running water or with a steam cleaner.

Recalibrate ceramic ovens from time to time to ensure accurate temperatures.

FIRING

Follow the recommendations of the ceramic manufacturer.

The coefficient of thermal expansion of conventional high-fusing ceramics vary with the number of firings and the furnace holding times (this includes post-firing soldering). The longer and the more frequently the material is fired, the more the coefficient of thermal expansion of the ceramic material will increase. Adaptation to the coefficient of thermal expansion of the alloy, which as a rule remains constant, is effected by varying the cooling rate from firing to standby temperatures.

For alloys with a thermal expansion coefficient of 25 - 500 °C we recommend...

>14,4 µm/mK	Long-term cooling
14,0 - 14.4 µm/mK	Normal cooling
< 14.0 µm/mK	Short-term cooling

Should these recommendations (see also „Special Processing Notes“ in the information leaflets on the individual alloys) be at variance with the recommendations given by the ceramic manufacturer, the latter should prevail.

Seperate the individual pontics down to the core before each firing. Remove oxide mechanically and/or by pickling from oxidized and non-veneered surfaces.

Special procedures must be followd for firing alloys for low-fusing ceramic materials (see also „Special Processing Notes“ in the information leaflets on the individual alloys). In the case of resin veneers, pre-treat the veneering surface following the instructions given by the resin manufacturer and then apply the veneer.

SOLDERING

We recommend the use of solders specifically adapted to the composition and melting range of our alloys (see also „Solders“ in the information leaflets on the individual alloys).

Observe the following when preparing for the soldering step:

- Soldering gaps should run as parallel as possible
- Soldering gaps 0.1 - 0.2 mm in width
- Grind Soldering area until bright
- Allow for a soldering area which is sufficiently dimensioned in the interdental regions.
- Keep the soldering block as small as possible.

The invested parts to be soldered should be heated slowly to the appropriate working temperature for the solder. Avoid local overheating when soldering with an open flame. When soldering in a furnace, the furnace temperature should exceed the working temperature by 50 to 60 °C (but generally follow the ceramic furnace manufacturer’s instructions for soldering).

When soldering framework parts with fired ceramics, the ceramic material must not come into contact with the soldering investment. We recommend the use of universal flux to minimize the formation of metal oxides and for additional oxidation protection, e.g. Cehaflux. For protective coverage we recommend colloidal graphite. Allow to cool slowly and evenly after soldering. Remove any residual flux or marginal oxide and clean the surface with pickling acid and/or mechanically.

HARDENING

Alloys that can be tempered will reach approximately their tempered-state hardness when allowed to cool slowly inside the casting ring. Post-firing hardness is usually sufficient to meet requirements. If this is the case, no additional heat treatment is required.

The tempered state is attained by additional heat treatment (see also Vickers hardness after firing“ and „Heat treatment after firing“ in the information leaflets on the individual alloys). This step should constitute the last thermal treatment of the casting.

POLISHING

Polishing improves the structure and quality of the metal surface.

To avoid smudging, use slow speeds and low pressure for polishing pressure should be.

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