DENTAL ALLOYS
TROUBLESHOOTING

NOBIL-METAL® S.p.A.
DENTAL ALLOYS & SOLDERS

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Problem: Porosity

Cause: Ring too hot
Remedy: Calibrate burnout furnace. A too high burnout temperature could interfere with the alloy cooling and set phase with negative effects on the metal structure.

Cause: Ring too cold
Remedy: Calibrate burnout furnace. A too low burnout temperature prevents complete burning of wax and/or plastic pre-shaped items: if they do not burn completely, residues form that are trapped causing porosity.

Cause: gases trapped in the investment
Remedy: take care the investment is not thicker than 5 mm on top of the moulded piece. Do not forget to remove the excess investment in order to have a porous wall capable of improving gas exit.

Cause: poor sprueing
Remedy: with direct channels a 3 mm minimum diameter is recommended. With the indirect method use a 5 mm diameter bar with 3-4 mm diameter feeding channels. Then connect the moulded piece to the bar with 3 mm long channels and equal diameter.

Cause: shrinkage cavities (thermal centre)
Remedy: check position of moulded piece. This should be outside the thermal centre with the quantity of fused alloy being calculated on the moulded piece weight. Too much alloy and a wrongly positioned mould piece will cause the "liquid phase" to last too long resulting in shrinkage problems during alloy set.

Cause: overheated alloy
Remedy: overheating of the alloy generates gas inclusions, carbon absorption and oxidation of components with lower melting point (Zn, In, Sn, Ga etc.). Overheating could even engender a change in the physical and mechanical properties of some alloys with a high palladium content. Strictly follow the instructions of the manufacturer on casting temperatures.

Cause: trapped gas-wrong flame control
Remedy: take care the gas/oxygen ratio is correct and watch the flame area used. Special attention paid to these parameters prevents the alloy from absorbing carbon and/or hydrogen.

Cause: dirty or poorly burning wax
Remedy: be careful not to contaminate wax with non-combustible material inclusions (ceramic powder, investment material, metal powder, etc.). Keep boxes closed after use. Some plastic pre-shaped items could need longer burnout times than plastic to remove any residues: set a longer burnout time if required.

Problem: Brittle Metal

Cause: overheated alloy
Remedy: Overheating of the alloy may result in increased grain size. A metal with oversized grains becomes brittle and has poorer mechanical properties. Special care in flame control should be paid when working with palladium-based alloys.

Cause: Poorly regenerated alloy
Remedy: to maintain the alloy characteristics, always add a 50% min. fresh alloy. Also, special care should be taken in cleaning the risers to use: a careful sand blasting and a steam or ultrasound cleaning are recommended.

Cause: Ring too hot
Remedy: as with overheated alloy, keeping the alloy at too high a temperature causes the grain size to increase and the alloy becomes brittle. Check calibration of the burnout furnace.

Cause: contaminated alloy
Remedy: a contaminated alloy will not maintain its physical and mechanical properties. Carefully clean the melting pot. Do not mix other alloys' residues. Keep the finishing tools (burrs, stones, etc.) used with each alloy separate.

Cause: cooling after casting too quick
Remedy: if cooled down too quickly some alloys could suffer a thermal shock resulting in a change of their mechanical properties. Strictly follow the instructions of the manufacturer.

Cause: porosity
Remedy: porosity weakens the metal structure and increases sensitivity to corrosion. Follow the instructions in the previous paragraph to prevent porosity.

Problem: Fractures

Cause: brittle alloy
Remedy: avoid overheating the alloy. Carefully adjust the torch (1.5-2:0.5-1oxygen-gas ratio). Carbon is greatly responsible for brittleness. Carbon can develop from: investment, unburnt or polluted wax, wrong ratio to the torch (mainly a flame too rich in gas). Use phosphate investment materials. Carefully clean all materials and tools used in the casting base.

Cause: abrupt stop of the centrifuge
Remedy: an abrupt stop of the centrifuge may result in a non-homo-geneous internal structure of the alloy. Very large grains could form next to much smaller ones, generating "stresses" that would, sooner or later, cause fractures in the structure. A natural stop of the centrifuge is recommended.

Cause: sudden cooling in water
Remedy: a sudden cooling in water could cause stresses in the structure. This should be avoided with ceramic alloys, in particular with high-palla-dium content ones. Strictly follow the instructions of the manufacturer.

Cause: Too high burnout temperature
Remedy: a too high temperature of the ring prevents a quick set. The result is a growth of the average grain size and a higher alloy brittleness with higher risk of fractures. Check burnout furnace and follow the man-ufacturer's instructions.

Cause: overheated alloy
Remedy: overheating of the alloy affects the alloy cooling phase preventing formation of small size grains. Oversized grains make fracture risk higher. Check burnout and the alloy casting temperature.

Cause: non regenerated alloy
Remedy: with the high palladium content alloys in particular, always add a 50% min. fresh alloy. With repeated casting some minor components could sublime and be enable to guarantee the alloy chemical composition and, therefore, its typical characteristics.

Problem: Rough surface

Cause: stress reducer
Remedy: remove the excess stress reducer using a light air blow.

Cause: too high burnout temperature or too quick burnout
Remedy: Calibrate the furnace. Strictly follow the manufacturer's instructions.

Cause: investment powder/liquid ratio
Remedy: The higher this ratio the greater the risk of a rough surface. Carefully check the powder/liquid ratio.

Cause: Investment not thoroughly dry
Remedy: strictly observe the setting time parameters given by the in vestment manufacturer before attempting the burnout phases.

Cause: plastic or wax residues
Remedy: Make sure wax and/or plastic residues are completely eliminated during burnout as they could carbonise and make surfaces rough.

Cause: expired investment
Remedy: an expired investment could break during burnout. Check the expiry date.

Problem: Shrinkage cavities

Cause: overheated alloy
Remedy: Decrease casting temperature.

Cause: too much riser
Remedy: the riser mass affects the casting cooling process. If it is kept in liquid state too long when it sets the metal shrinks reducing its volume and generates the so-called "shrinkage cavity" phenomenon. Determination of the weight of the alloy to cast is recommended (weight of the wax moulded piece x Alloy Specific Weight = Weight of the casting).

Cause: sprue size
Remedy: use bigger size sprues.

Problem: Rounded edges

Cause: low burnout
Remedy: calibrate the furnace. Increase the final stabilisation time.

Cause: too low casting temperature
Remedy: the alloy should be cast at a temperature approx. 150°C higher than the liquid temperature.

Cause: too much investment over the top of the moulded piece
Remedy: make sure you have about 5 mm investment over the top of the moulded piece. Smooth the top of the investment to have a porous surface. This will help the exit of any trapped gas that could hinder the flowing of the alloy.

Problem: Incomplete castings

Cause: low burnout
Remedy: calibrate the furnace. Increase the final stabilisation time.

Cause: poor sprueing
Remedy: with direct channels a 3 mm minimum diameter is recommended. With the indirect method use a 5 mm diameter bar with 3-4 mm diameter feeding channels. Then connect the moulded piece to the bar with 3 mm long channels and equal diameter.

Cause: moulded piece not thick enough
Remedy: a minimum 0.3-0.4 mm thickness should be kept. Below this thickness successful casting cannot be guaranteed.

Cause: Lack of centrifugal force
Remedy: check the centrifuge pickup force. With low specific weight alloys, increase the centrifuge pickup force.

Cause: Incomplete wax removal
Unburnt wax traces could "clog" the investment porosity preventing the flow of air. Air and humidity coming into contact with the fused alloy cause a harsh reaction capable of preventing the filling of the cast.

Cause: Position of moulded piece relative to the centrifuge
Remedy: The moulded pieces must be placed in opposite direction to direction of rotation.

Cause: too low casting temperature
Remedy: the alloy should be cast at a temperature approx. 150°C higher than the liquid temperature.

Cause: gas trapped in the investment
Remedy: make sure you have not more than 5 mm investment over the top of the moulded piece. Smooth the top of the investment to have a porous surface. This will help the exit of any trapped gas.

Problem: "Pin porosità" in the casting

Cause: too high burnout temperature
Remedy: Calibrate the furnace and strictly follow the manufacturer's instructions.

Cause: investment particle inclusions in the casting
Remedy: use a good quality investment material. Take care not to create sharp edges when modelling; the fused alloy could take off the raised parts of the investment.

Cause: dirty or poorly burning wax
Remedy: be careful not to contaminate wax with non-combustible material inclusions (ceramic powder, investment material, metal powder, etc.). Keep boxes closed after use. Some plastic pre-shaped items could need longer burnout times than plastic to remove any residues: set a longer burnout time if required.

Cause: overheated alloy
Remedy: Decrease casting temperature.

Cause: the alloy used is not clean
Remedy: carefully clean the risers you re-use. Sand blast the surface and clean with steam or ultra sounds.

Problem: "Metal balls or blisters" on the casting

Cause: investment casting too quick
Remedy: mix the investment material as instructed by the manufacturer. Be careful to cst the investment without trapping air in it.

Cause: tension reducer was not used
Remedy: use a good quality tension reducer and take care to remove the excess reducer with a light blow of air.

Problem: Investment inclusions in the metal

Cause: 90° angles in the modelling piece
Remedy: avoid sharp edges and corners in the modelling piece, and mainly in the sprues.

Cause: rough casting cone
Remedy: pay attention to the moulded piece and the base cone removing any cause for roughness in the moulded piece.

Cause: too high burnout temperature
Remedy: Calibrate the furnace and strictly follow the manufacturer's instructions.

Problem: Casting inaccuracy

Cause: high investment expansion
Remedy: crowns fit largely on the die. Check the powder/liquid ratio. Use a thinner spacer.

Cause: poor investment expansion
Remedy: crowns do not fit on the die. Check the powder/liquid ratio. Use a thicker spacer. Do not use plastic copings.

Cause: uncontrolled investment (powder/liquid) temperature
Remedy: Liquid and mix temperature are directly related to the casting accuracy. The higher the liquid and mix temperature, the larger the dimensioning of the casting.

Problem: Non-homogeneous oxidation

Cause: contaminated burrs
Remedy: use a burr for each individual alloy and/or material. Always thoroughly clean them.

Cause: Dirty or greasy alloy surface
Remedy: avoid touching the metal with your fingers. Fingers' grease or sweat cause problems during the oxidation phase. Clean the structure with ultra sounds or steam jets.

Cause: inaccurate oxidation cycle
Remedy: the oxidation cycle time could be too short or too long. In this instance the formation of oxides layer would not be the optimum one. Sand blast the surface and follow the instructions of the manufacturer.

Cause: re-fused alloy
Remedy: when the alloy is fused several times without being regenerated some alloy components responsible for the formation of oxides could volatilise. Always add 50% minimum fresh alloy.

Cause: alloy contaminated by another alloy
Remedy: an alloy contaminated by other metals will no longer maintain the characteristics declared by the manufacturer: colour and oxidation homogeneity could be a visual indication of it. The use of clean and separate melting pots for each alloy is recommended. Do not unpack the alloy ingots until you need to use them. Clearly identify the risers and casting residues.

Problem: Alloy corrosion and tarnishing

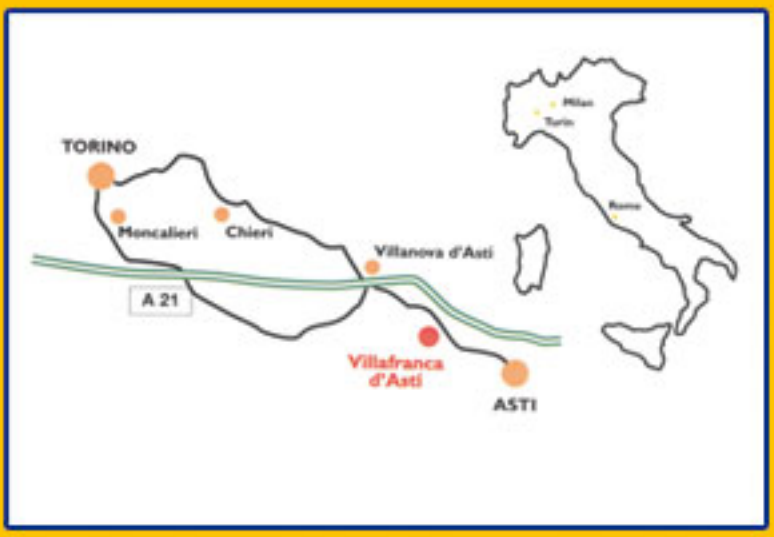
Cause: porosity
Remedy: besides weakening the metal structure, porosity can cause corrosion phenomena. As a matter of fact organic particles, food residues, and bacterial cells could colonise micro-porosities, forming large bacteria aggregates interacting with the metal. A first effect is the accumulation of material on the surface with a change in colour and then the development of sometimes strong corrosion reactions leading to a mechanical weakness of the structure. See the “porosity” chapter on how to avoid this problem

Cause: contaminated alloy
Remedy: be careful not the add other alloys or brazing residues when melting or brazing. The resulting new chemical composition could generate eutectics poorly resisting corrosion.

Problem: Chemical corrosion

Cause: spit and medicine acidity
Remedy: some people have a high acidity spit or are being treated with special medicines (heart problems) reacting with some of the alloy components. Consult your doctor to check the conditions above. Some food (e.g.: eggs) contain special compounds (sulphur-based) interacting with the alloy. It has been reported of several sulphides capable of corroding silver and copper.

Cause: galvanic corrosion
Remedy: the presence of two or more alloys in the mouth could cause a potential difference such as to set off galvanic corrosion phenomena. It is highly recommended that the patient's mouth condition be checked and, if doubts exist, the manufacturer be contacted.



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