HeraCeram Questions & Answers

Users always ask the best questions, both regarding our products or regarding specific dental sectors. Our specialists' answers offer you an orientation guide to solve problems in your own laboratory.

General

What makes Kulzer ceramics different from ceramics of other competitors on the market?

In order to avoid possible mistakes during the processing of the ceramic, our ceramics are produced to eliminate basic working steps in the laboratory. One of them is, for instance, the matching of the ideal CTE of the ceramic to the alloy, including the slow cooling of the ceramic after the firing cycle. In our ceramics, the cooling phase is already built into the ceramic itself. This is achieved through an innovative production process, which results in a controlled and fixed leucite crystals structure, that we named SLS, which stands for Stabilized Leucite Structure. This makes the ceramic highly resistant to firing, allowing a fast firing cycle and makes a slow cooling of the fired object unnecessary.

What is the best way to control the ceramic shrinkage?

The degree of the ceramic shrinkage depends on the condensation of the layered ceramic. Too much modeling liquid or liquids which improve the stability, reduce the condensation of the ceramic and produce more and bigger empty spaces between the ceramic particles. During firing, these particles melt together and the general volume of the object shrinks. The shrinkage can be reduced if during the layering, the ceramic is often condensated, removing the liquid binder through gentle tapping.

Can simple water be used instead of the modeling liquid to mix the ceramic powder?

Basically yes, simple water can be used too. The modeling liquid only serves as an auxiliary binder during the working process and is not a component of the ceramic itself. Its task is just to give the ceramic the optimal consistency during the working process. It also influences stability during the layering of the ceramic and the drying time of the ceramic-liquid mixture. Simple water doesn't offer these advantages.

The consistency is freely determined by the user.

Important is, that the liquid used will completely evaporate during the ceramic firing cycle. To achieve this, the instructions for use regarding the pre-drying and pre-heating procedures of the liquid used to mix the ceramic must be strictly followed.

Why does the ceramic shrink during firing?

Basically, the shrinkage of the ceramic during firing process cannot be avoided. To bring the ceramic powder to a working (modeling) consistency, the powder must be mixed with a liquid. During the mixing the empty spaces between the ceramic particles are filled with the liquid. After the drying phase, the liquid will have completely evaporated, leaving empty spaces between the ceramic particles. During the firing cycle, the ceramic particles melt together thereby closing the empty spaces left behind by the liquid. During this phase the layered ceramic shrinks and reduces its volume.
The deciding factor is the amount of the shrinkage, which depends on the size of the empty spaces between the ceramic particles, in other words, how much and how well the ceramic-liquid mixture has been condensed. The condensation is influenced, on one hand by the grain morphology of the ceramic powder, and on the other

hand by the individual working procedure. Very wet layering and little condensation result in the reduced density of the ceramic and therefore to a high shrinkage, with the collateral effects of fractures and partial lifting of the ceramic from the supporting structure. Moreover, liquids that increase the stability of the ceramic during layering also reduce the condensation, causing higher shrinkage of the object. The higher the density of the ceramic particles during the layering, e.g. through condensation of the mixture, the smaller the shrinkage during the firing procedure.

HeraCeram Zirkonia

Can metal firing pins be used with Zirconia supporting structures?

In order to avoid any possible contamination through metal or metal oxides, ceramic firing pins should be used.

Firing procedure

How do I determine the right firing temperature for my ceramic firing furnace?

First it should be checked whether the furnace corresponds to the calibration done in the factory, and eventually a new calibration of the furnace should be done.

Nevertheless, whether the furnace fires with the "right" firing temperature should always be judged through the firing results. To do this, standard (thus comparable) firing samples should be prepared. This can be an anterior crown or a ceramic sample made with a shape former. This sample should be positioned on the firing tray at the same height and at the same distance from the edges of the tray as it is usually done with a ceramic crown. The firing sample is positioned on a "plane" made of several firing pins on which a thin layer of firing wool or platin foil is placed. For this test, only the clearest ceramic, e.g. Transpa Clear, should be used.

When the firing temperature is correct, the ceramic appears thoroughly and homogeneously fired and transparent, the surface has a structured glaze and the edges of the shape have a sharp contour.

If the edges are rounded, the firing temperature is too high.

If the surface is very dull and if a milky core is visible inside the ceramic, the firing temperature is too low.

In both cases the firing temperature must be adjusted.

Why can Kulzer ceramics be fired with a heat rate of 100 °C?

Thanks to the Stabilized Leucite Structure SLS, Kulzer ceramics have very strong firing properties. Additionally, the ceramics are calibrated so that with this heat rate they receive enough energy for a correct sintering process.

How does the cooling speed influence the ceramic?

In the case of a slow cooling, it must be differentiated between the slow cooling to control the Coefficient of Thermal Expansion (CTE) and the so called "tension relieving cooling".

To control the CTE, the ceramic, during the cooling phase, is brought to a temperature where it continues to further build-up the leucite crystals, thereby increasing the CTE of the ceramic. This procedure is for the

HeraCeram ceramics not necessary because, thanks to the stabilized leucite structure SLS, it has already been done in the factory during the production of the ceramic.

The tension relieving cooling prevents that in addition to the tensions caused by the CTE difference between the ceramic and the supporting frame material, additional tensions formed during a non-uniform cooling of the fired object may altogether bring the ceramic to a critical situation that could cause fractures and chipping. With HeraCeram, this tension relieving cooling is of a secondary importance, as the tensions due to the CTE are very minimal thanks to the optimal matching to the material of the supporting frame, so that the danger of a critical condition does not exist.

What is the ideal heat rate for the veneering of zirconium oxide frameworks?

Due to the low thermal conductivity of zirconium oxide frameworks, it is generally recommended to use a low heat rate during the firing of the ceramic in the furnace. However, zirconium oxide, in fact, has a better thermal conductivity than the veneering ceramic and the basis for such recommendation is wrong. During the firing of the ceramic, the amount of applied energy, in relation to the needed amount of energy, is a deciding factor for the degree of the ceramic sinterization. This amount of energy is controlled, during the firing procedure, through temperature and time. For the control through the time, there are two parameters available: the heat rate and the holding time at final temperature. The total amount of energy needed is determined by the energy necessary for both the veneering ceramic and the material of the supporting framework. These are determined by the respective mass and the respective specific quantity of heat necessary.
Zirconium oxide has a higher specific heat quantity compared to e.g. preciuos alloys, therefore the same mass of zirconium oxide needs more energy to warm up compared to precious alloys. Since the sintering process takes place from the outer to the inner layers, and thus, only through the layered ceramic veneering, the thermal conductivity plays only a negligible role.
To achieve a homogeneous firing (sintering degree) it is important for the object to have a low temperature gradient, that means a possibly uniform heat distribution. This can also be achieved through a low heat rate; this procedure is very time consuming, though. Another way is to have a sufficient pre-heating of the firing object before beginning to increase the temperature. This procedure has the advantage of a uniform temperature throughout the whole firing object. Throughout the subsequent heating, even with a heat rate of 100°C/min, only a minimal temperature gradient will be formed, thus resulting in a uniform firing.
Consistent pre-heating has the additional advantage that the sintering process starts simultaneously also at the surface of the supporting framework and prevents, for example, the retraction of the ceramic from the margins or its uncontrolled lifting or tearing.

In case of large ZR frameworks should the heat rate be changed?

In case of very large supporting frameworks with a lot of mass, inspite of good pre-heating procedure it is not always possible to achieve a uniform heat distribution throughout the firing object. In these cases a lowering of the heat rate is of advantage.

Bonding

How does the bonding between ceramic and zirconium function?

In contrast to the bonding between ceramic and metal, the bonding between ceramic and zirconium is different and cannot be achieved mechanically nor chemically, because the zirconium surface cannot build micro retentions through sand blasting as it is usually done with the surface of metal alloys. For the same

reason, zirconium is chemically so stable that it is not possible to achieve a chemical bonding with any of the ceramic components.
For sufficient and sure bonding, HeraCeram Zirkonia uses the adhesive forces resulting from a perfect wetting of the zirconium oxide with the Zr-Adhesive. These bonding forces are so strong that a separation is only possible with a simultaneous destruction of the ceramic veneering

How often is it necessary to perform a furnace purification firing cycle when precious or NPM alloys are used?

The purpose of furnace purification firing cycle is to clean the firing chamber from contamination particles that can influence the reproduction of the dental shade.
The firing chamber is pre-heated under vacuum at 1050-1100°C and kept for 15 minutes at final temperature.
During the purification firing cycle it is possible to also fire the ceramic firing tray.
Do not use activated Carbon!
The frequency of the purification firing cycle depends on the type of alloys used as supporting frameworks and how often they are fired in the specific furnace.

What exactly is „Chipping“?

„Chipping“ is a special form of ceramic breakage that has occurred particularly with ceramic veneering on zirconium oxide supporting frameworks.
The amount of the "Chipping" cases is alarming because this type of breakage occurs even when all other error factors that can also cause a failure with porcelain-fused-to-metal restorations (e.g. lack of support by the metal framework) have been eliminated.
"Chipping" is when small pieces break off from the ceramic veneering.
The cause of this problem is the use of leucite-free veneering ceramics which are available on the market.
In this type of ceramics, actually they should be called glassy materials, small micro-fractures which occur in the veneering can grow unimpeded until they become visible fractures that unavoidably cause the chipping.

Preparation of the framework

What must be observed for the veneering of NPM alloys frameworks?

The biggest challenge for the veneering of NPM alloys framework is the heavy formation of oxides on the surface of the alloy. Oxides do support the chemical bonding, however in excessive amounts the oxide layer practically acts like an insulating layer, preventing the necessary wetting by the ceramic.
For this reason, during the veneering of NPM alloys frameworks, the formation of oxides should, when possible, be avoided (is an oxidation firing necessary?) or the existent oxides reduced.
For the ideal treatment of NPM alloys surfaces, Kulzer has developed the HeraCeram NP-Primer, that avoids the uncontrolled formation of oxides and reduces an existent oxide layer so much so that a perfect wetting of the ceramic on the framework surface and a reliable bonding of the ceramic can be ensured.

Can the HeraCeram NP-Primer be used for all alloys and ceramics?

The NP-Primer is effective on all NPM alloys, but is has been tested and approved only for HeraCeram and HeraSun.

Can Zirconium oxide be sandblasted?

In order to avoid possible damage to the material, after the sintering process the surfaces of zirconium oxide should not receive any further treatment after the sintering process. In case sandblasting cannot be avoided, the pressure used should be as low as possible.

Why should only carbide cross cut burs be used for the finishing of the frameworks?

Only (sharp) carbide burs allow a problem-free swarfs flow. Other instruments, like diamonds or stones, do not have a definite cutting geometry. This can cause the metal swarf to be lifted up but not cut away. The result is an overlapping of the swarfs, which compromise the bonding and leads to the formation of bubbles in the ceramic veneering.

Why is the framework sandblasted?

Through the sandblasting procedure the metal surface form micro retentions which will improve the mechanical retention of the ceramic on the metal.

What is to be observed during the sandblasting?

1. The abrasive material should have a grain size of 100-150 µm. If the grain size is too small, the retentions on the metal surface will not be of the correct size. If the grain size is too big there is a real danger of damaging, for example, the margins of the crown.
2. The pressure of the blasting must be adapted to the hardness of the alloy. If the pressure is too low the metal surface will not form the correct retentions. If the pressure is too high, delicate parts like the margins of the crown may be deformed and particles of the abrasive material can penetrate the metal surface.
3. The blasting direction should not be perpendicular to the metal surface, otherwise particles of the abrasive material could penetrate the alloy surface.

Why is an oxidation firing necessary?

Through the oxidation firing organic contaminations can be removed. The oxide layer formed during the firing can give information as to whether the structure of the alloy surface has shrinkage porosity.

With some type of alloys, the oxidation firing is a necessary procedure for the reduction of specific metal oxides (Cu, Zn).

At what temperature should the oxidation firing be done?

Basically, the recommendations of the instruction for use of the specific alloy must be observed.
From the ceramic point of view, the oxidation firing temperature should be at least as high as the highest temperature of the firing of the ceramic, e.g. the "Wash opaque firing".

Should the oxidation firing be done under vacuum?

Basically, the recommendations of the instruction for use of the specific alloy must be observed.

Why is the oxide layer removed?

The oxidation firing is not for the purpose of forming the so called "bonding oxides". These oxides form by themselves anyway in enough quantities during the firing of the ceramic.
An oxide layer that is too thick affects the wettability of the alloy surface by the ceramic and therefore has a negative influence on the bonding between the two materials. For this reason the oxide layer should be removed.

How can the oxide layer be removed?

Basically, the recommendations of the instruction for use of the specific alloy must be observed.
Usually the oxide layer is removed by sandblasting with abrasive material. In this case, the same recommendations for the sandblasting of the finished framework are valid.
For alloys for which the oxidation firing is intended to reduce specific metal oxides (Cu, Zn), the oxide layer should be removed with a pickling agent. For the pickling procedure please observe the instruction for use of the alloy!

What is the function of the NP-Primer?

The NP-Primer prevents an excessive formation of oxide on frameworks of NPM alloys. The wettability of the veneering surface is thereby increased and a reliable bonding between the two materials is guaranteed.

Why is the NP-Primer paste so hard?

The NP-Primer paste is thixotropic. If the paste is not used for a long time its consistency becomes hard. Through movement, e.g. during mixing, the paste becomes soft again and it reaches the normal viscosity.

How can a dried-up NP-Primer paste be diluted?

Like all ceramic pastes from Kulzer, the NP-Primer paste can be diluted with the Paste Opaquer Liquid (POL). Attention: an excessive dilution of the NP-Primer makes the product unusable!

Can the NP-Primer be used also with precious alloys?

The NP-Primer is specially conceived to be used with NPM alloys. The use of the product with precious alloys brings no advantages because in this case the oxide formation is not critical. The firing temperature of 950°C could cause a deformation of the framework!

When the NP-Primer is used, is the colour of the surface of the framework of importance?

The colour of the oxides can vary according to the alloy type and is no indication for the efficiency of the NP-Primer

Is it of disadvantage if the layer of the NP-Primer is applied too thick?

Not considering the cost caused by an excessive use of the material, a thick layer of the NP-Primer brings neither disadvantages, nor advantages.

After the NP-Primer must the Pre-Opaquer also be used?

No, it is enough to use either one of the products.

Should the Zr-Adhesive be fired prior to the staining of full anatomical zirconium oxide frames?

No, the wetting properties of the Stains and the Glaze universal are so good that an adhesive firing is not necessary.

Opaquer application

When the opaquer paste has become too dry how can it be diluted?

Like all ceramic pastes from Kulzer, the opaquer paste can be diluted with the Paste Opaquer Liquid (POL). Attention: an excessive dilution of the NP-Primer makes the product unusable!

Can the opaquer (powder or paste) also be applied and fired in one masking layer?

The opaquer must always be applied and fired in a very thin layer. When applied in thick layers, the very fine ceramic particles of the opaquer tend to have a bigger shrinkage which will cause the formation of fissures and porosity.

Can the opaquer paste and the opaquer powder be combined?

It is always possible to apply and fire a layer of opaquer powder on a layer of opaquer paste or viceversa. The paste and powder should however not be mixed together otherwise the working properties will be affected.

What happens when the firing temperature of the opaquer is too low?

In this case the opaquer layer shows a much duller surface. A firing temperature that is too low effects a lesser dissolution of the oxides and wetting of the surface. This will affect the bonding negatively.

What happens when the firing temperature of the opaquer is too high?

When the firing temperature is too high, the opaquer surface shines more than usual, but the bonding properties are not affected.

Can the opaquer be modified with stains?

In minute quantities (until 3 % of stains) this causes no problems. If a higher intensity of colour is required, we recommend the use of the Intensive-Opaquer material.

Liner application

Does the ZR Liner also work with other ceramics?

Compatibility tests with competitors 'ceramic systems have not been carried out

Glaze firing

To glaze the ceramic is it compulsory to use glazing material?

The glaze firing can be done also without the use of glaze material. The advantage of using the glaze material is that the desired level of glaze can be achieved with less energy and the delicate texture and contact points of the ceramic can be better maintained.

Mixing liquids

How do the different mixing liquids affect the ceramic?

Mixing liquids support the plasticity of the ceramic during the working procedure.
Mixing liquids improve the stability during the layering and prevent the ceramic from "flowing away". Different mixing liquids have different levels of efficiency. The modeling liquid "MLS" improves the stability to a higher degree than the liquid "ML". However, as a collateral effect to the higher stability, there will be a higher level of shrinkage with all its disadvantages.

So called "Long term liquids" (not present in the HeraCeram program) keep the ceramic wet during the layering and at the ideal consistency for modelling.
Opaquer liquids "OL" give the opaquer powder a "lacquer-like" consistency and enable the application of thin layers on the surfaces of the framework..
"SM" liquids give the margin material a good modeling consistency and after drying a "green strength" which allows sure and safe handling, for example, the safe removal of the shoulder material from the model.
The stain liquids "MF" and "SLU" have the task of controlling the consistency of the stains so that the stain material can be applied on the ceramic surface in a controlled manner. Because of the refractive index of the stains liquids the colours are also well visible even before the firing procedure, thus supporting a controlled colour reproduction.

Stains

Which stains do I need for Zirconium?

With the classical staining procedure and individual colouring of ceramic veneering surfaces, the compatibility between the ceramic and the stains doesn't depend so much on the CTE. Due to the very thin layer and the minimal amount of material it depends rather on a sufficiently low firing temperature. For this reason HeraCeram Stains universal can be used with all lines of products.
In the staining technique as it is implemented on monochromatic systems (pressable ceramic, fully anatomical zirconium oxide), the stains and the glaze, having been applied in thicker layers, have a colour constituting task. For this type of use, it is imperative that the CTE of the stains matches that of the veneering ceramic. With HeraCeram stains universal Kulzer offers stains and glazing material which are compatible with all Kulzer ceramics and zirconium oxide restorations.