NACERA® CLEAN

REPORT

PROBLEM

Many dental laboratories are unwittingly affected by this problem: the sneaky process of discolored zirconia restorations after sintering. These discolorations are caused by metal ions. The reasons for this can be various.

REASON I:

Coloring liquids contain high concentrations of metal ions. The liquids are applied by brushing or dipping superficially on the material and react during the sinter firing. These are incorporated into the structure and generate the coloring effect. The ions evaporate during sintering into the furnace atmosphere. After cooling the furnace, these particles are deposited in the combustion chamber and on the sintering tray. During the next sintering process, these ions are mobilised and react with the zirconium oxide to create discolorations or color deviations restorations (see Fig. 4.).

Fig. 1: Exemplary contamination of white material. The left crown is sintered in a pure furnace atmosphere, the right crown in a contaminated environment. The effect of coloring metal ions is clearly visible.

REASON II:

Most heating elements consist of molybdenum disilicide. The silicon which is therein contained, forms a vitreous protective layer on the surface of the heating elements and prevents oxidation of the molybdenum (see fig. 2). Over time, crystals (silicon dioxide, SiO_2 or quartz) are formed in a glass melt which grows to form islands and finally cover the entire surface of the heating element (see fig. 3). Frequent cause of this is the non-reaching of the maximum temperature of the heating elements during the sintering process. Due to the fast temperature changes of the heating elements - in few seconds from "cold" to light red glowing - these crystals are subject to high mechanical stresses during heating tensions.

Individual particles are thereby blown out and thrown into the furnace chamber. A single SiO_2 particle is sufficient to produce large yellow stains on zirconia over a large area.

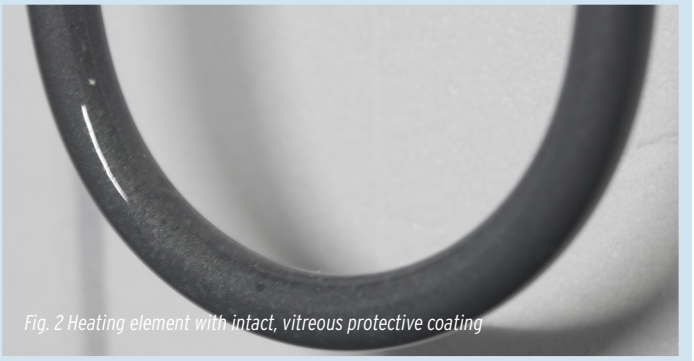

Fig. 2 Heating element with intact, vitreous protective coating

Fig. 3: Crystals of quartz crystals lead to contamination

Fig. 4: Coloring ions in the oven atmosphere

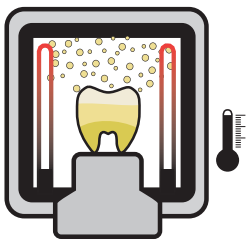

Fig. 4. 1: Ions dissolve from heating elements and coloring liquids at high temperature

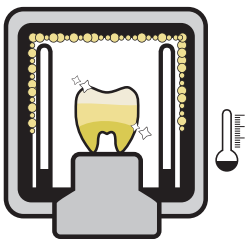

Fig. 4. 2: Ions react with the sintered zirconia. While cooling down the ions deposit in the combustion chamber.

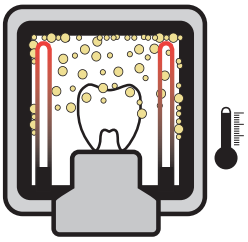

Fig. 4. 3: During the next sintering process the ions dissolve again ...

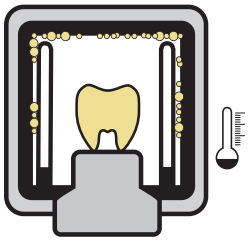

Fig. 4. 4: ... and react with the zirconia. Discolorations are the result.

During the sintering process there is the risk that silicon ions will dissolve from heating elements and be released into the furnace atmosphere. As a result of the temperature in the combustion chamber, the silicon is sublimated into a gaseous aggregate condition and thus reacts with the zirconium oxide restorations, which are contaminated by that fact. Yellow stains on the surface of the restorations are the result after sintering.

For heating elements made of silicon carbide this problem is not given, because there are no particles in the oven atmosphere, which produce discolorations of the sintered material. Furnaces with these heating elements have the advantage that the restorations can be sintered without sintering lids. In direct comparison to molybdenum disilicide heating elements the whole emerging energy is entered into the sintering object such as, e. g. thermal radiation which is shielded by the use of sintering covers. Another advantage of the silicon carbide heating element is that it can be rapidly cooled down without damaging the elements.

This has advantages in the so-called speed-programs.

SOLUTION AND PREVENTION

Nacera® Clean with its improved formula helps. The cleaning powder - which is even more reactive than the zirconium oxide of the sintered blanks - ensures color-translucent zirconium oxide restorations by binding residues of coloring liquids and other impurities within the combustion chamber in the powder and cleans the furnace atmosphere.

Why does Nacera® Clean absorb the impurities rather than the restoration?
Because the Nacera® Clean cleaning powder provides a much larger and more reactive surface than the zirconium oxide restorations, on which the impurities in the furnace atmosphere can settle. Nacera® Clean offers ideal conditions for clean and constant color results after sintering. The reworked powder formulation allows an even more intensive furnace cleaning with less consumption.

TIP FOR SINTERING WITH LID

Mark the upper side of the cover of the sintering tray by means of a milled marking and position it with the marked side facing upwards during subsequent sintering passages. This prevents particles, which have deposited on the surface of the cover during the sintering process, from being deposited onto the sintered objects during the next sintering process and causing discoloration.

Fig. 5: Nacera® Clean bottles with 50 g and 200 g content

SIMPLE APPLICATION

For the **basic cleaning** of the sintering furnace, 30 - 50 g of the Nacera® Clean powder is filled in a sintering tray which is placed with a cover in the oven. The normal sintering program is carried out. Subsequently, "fresh" powder can be positioned for regular cleaning right next to the sintered object or as a sinter base with the same utility as very fine sintered beads.

Important: If several sintering trays are used, fill them with Nacera® Clean and place all of them together in the oven for the final cleaning including the lid.

Already 10 g of the powder are sufficient to prevent re-deposits in the combustion chamber. The powder can be distributed all round on the inner edge of the sintering tray. If discolorations occur on the restorations, a thin layer of Nacera® Clean can be distributed on the bottom of the sintering tray. If the heating elements show superficial crystallization, light gray color and tangible roughness, a regeneration firing given by the oven manufacturer should be carried out.

The empty furnace is heated and held at a very high heating rate up to maximum temperature. This ensures that the crystals dissolve completely in the glass melt.

In order to perform a regeneration firing with Nacera® Clean, a sintering tray is filled with approx. 50 g Nacera® Clean as in the basic cleaning and positioned in the oven, too.

Nacera® Clean binds the crystal particles in the furnace atmosphere, while the silicon crystals on the heat conductors are again transferred into the glass phase (vitreous protective layer).

If the Nacera® Clean powder turns white, this is no longer reactive and can be disposed of via the residual waste.

Fig. 6: Nacera® Clean on a sintering tray before sintering

Fig. 7: Nacera® Clean on a sintering tray after sintering