



Refractory Investments

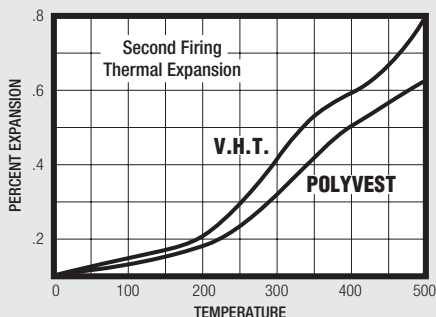
For Direct Firing Ceramics

V.H.T.

Refractory Die Material with High Thermal Expansion

Polyvest

Refractory Die Material with Medium Thermal Expansion



Physical Properties

| | Polyvest | V.H.T. |
|---|---|---------------------------------|
| Recommended Liquid Color | Special Liquid Concentrate – Plus White | Special Liquid Concentrate Blue |
| Liquid/Powder Ratio | 22 mL/100 g | 19 mL/100 g |
| Working Time | 2 minutes | 4–5 minutes |
| Setting Expansion (100% Special Liquid) | 0.80% | 0.30% |
| Thermal Expansion (500°C, 2nd firing) (100% Special Liquid) | 0.65% | 0.80% |
| Compressive Strength (1 hour) | 6,000 psi (42 MPa) | 2,500 psi (17 MPa) |
| Compressive Strength (after firing) | 6,500 psi (48 MPa) | 4,800 psi (34 MPa) |
| Maximum Furnace Temperature | 2,200°F (1,200°C) | 2,200°F (1,200°C) |
| Coefficient Thermal Expansion (CTE) | 13.6 x 10 ⁻⁶ | 16.5 x 10 ⁻⁶ |

* For changes in expansion rates please call Whip Mix Technical Support

Compatibility Guide

Polyvest

Use POLYVEST with medium-expanding porcelains:

| | |
|------------------|--------------------------------|
| Finesse | Dentsply/Ceramco, Inc. |
| Ceramco III | Dentsply/Ceramco, Inc. |
| Ceramco II | Dentsply/Ceramco, Inc. |
| Ceramco Veneer | Dentsply/Ceramco, Inc. |
| Color Logic | Dentsply/Ceramco, Inc. |
| Ceramco Silver | Dentsply/Ceramco, Inc. |
| Duceram | Dentsply/Ceramco, Inc. |
| Duceram Plus | Dentsply/Ceramco, Inc. |
| Duceram Kiss | Dentsply/Ceramco, Inc. |
| Excelsior | Dentsply/Ceramco, Inc. |
| Cercom-PVS | Jelenko Dental Health Products |
| Chameleon/Mirage | Myron International, Inc. |
| Vita-VMK 68/95 | Vident/Vita Zahnfabrik |
| Vita Omega | Vident/Vita Zahnfabrik |
| Syn-Spar | Jeneric/Pentron Inc. |
| Vintage | 3M/Lab Products |
| Halo | 3M/Lab Products |
| Silhouette | Dillon Company |
| Sensation | Dillon Company |
| G-Cera | G-C International Corp. |
| Avante | Jeneric/Pentron-Ceramics |
| Reflex | Wieland |
| D-Sign | Ivoclar |
| Noritake EX 3 | Noritake |
| CCR Press | Noritake |

V.H.T

Use V.H.T. with high-expanding porcelains:

| | |
|--------------|---------------------------------|
| Optec-HSP/VP | Jeneric/Pentron Inc. |
| Wil-Ceram | Ivoclar USA/Williams Dental Co. |
| Excelco | Ney Dental International, Inc. |
| Creation | Jensen Industries, Inc. |

All of the above porcelain brand names are trademarks of their respective manufacturers.



| Refractory | Polyvest | V.H.T. |
|--------------------------------------|--|---------------------------------|
| Type of Liquid | 100% Special Liquid Concentrate – Plus | 100% Special Liquid Concentrate |
| Liquid/Powder Ratio | 13.0 mL/60 g | 11.5 mL/60 g |
| Mixing Time (under vacuum) | 20 seconds | 60 seconds |

Once the correct refractory material selection has been made based upon compatibility with the porcelain system to be used, the all-ceramic restoration technique is basically the same whether veneers, inlays, onlays or full crowns are being fabricated. Some variations do, of course, arise depending upon which refractory is being used and which type of restoration is being made; these variations will be noted in the following technique instructions.

Models and Dies

Ideally, the dentist will provide an impression made with a stable, elastomeric-type material. Spray the impression with a fine mist of Whip Mix SMOOTHX, and blow dry with a gentle stream of air.

Pour a master model using a die stone such as Whip Mix PRIMA-ROCK, and separate after 30 to 45 minutes.

If the master model is to be duplicated, Whip Mix P.D.Q. SPACER can be used to provide relief before duplication.

If duplicating a Stone model a silicone based duplicating material is recommended.

If the refractory investment is to be poured into the same impression as the master model, be sure to pour the refractory model last.

Removable refractory dies can be fabricated using high-heat dowel pins, a reverse pinning procedure, or a removable tray system.

Pour the mixed investment into the impression with low vibration, taking care not to entrap air bubbles in critical areas.

Allow the poured model to bench-set for 45 to 60 minutes before separation from the impression.

Preparing Model for Degassing

Trim the refractory model to minimum bulk prior to degassing.

Outline the margins with a Prismacolor Verithin VT741 Indigo Blue Pencil, available at any art supply store. During the degassing of the refractory model, the markings will still be visible.

Block-Out Technique

Any undercuts present on the die should be blocked out before degassing the refractory model. A small quantity of refractory material should be mixed and applied only to the area to be blocked out.

1. Soak the case or die in water for 3 to 4 minutes (until no further air bubbles can be seen rising from the model or die).
2. Mix a small quantity of refractory powder and liquid to a creamy consistency on a glass mixing slab.
3. Shake excess water off the model or die, and apply with a brush mixed refractory into the undercuts. Contour to shape.
4. Dry and benchset for 1 hour. Proceed with degassing.



Degassing the Refractory Model

Prior to the application of porcelain, all refractory models and dies should be degassed to remove vapors that are not desirable during the firing of the porcelain. It is recommended that degassing the model should be accomplished in a two-step procedure, utilizing the burnout furnace for the first step and the porcelain vacuum furnace for the second step.

Alternatively, just the burnout furnace may be used for the full procedure. Do not use porcelain furnace for the entire procedure. Damage to the muffle can result. Both techniques are described below, but the dual furnace technique is preferred, since it prevents having to operate your burnout furnace at elevated temperatures and also allows the ceramist to apply spacer during the second part of the degassing cycle, thus saving time by eliminating a separate application later.

Degassing with Burnout and Porcelain Vacuum Furnaces (Preferred Technique)

1. Place the model in a regular, vented burnout furnace at room temperature, and increase the temperature to 1,500°F/816°C at 25°F/14°C per minute, with a hold time of 30 minutes.
2. Remove the model and allow to cool to room temperature.
3. Refractory material may now be applied as described below in the Spacer Technique section so that the spacer firing and the final degassing procedure will be accomplished in a single step.

Alternatively, you may wait until after degassing before applying and firing the spacer in a separate procedure.

4. If no spacer is being applied at this time, continue degassing by transferring and firing the model in a porcelain vacuum furnace using the following parameters:

Use a drying cycle of 6 minutes at an Idle Temperature of 1,200°F/650°C. Fire to 1,950°F/1,065°C with a rate-of-climb of 100°F/55°C per minute with vacuum pump

operating and with a final hold time of 2 minutes. No special cooling cycle is necessary.

Degassing with Burnout Furnace Only (Alternate Technique)

Place the model in a regular, vented burnout furnace at room temperature, and increase temperature to 1950°F/1065°C at 25°F/14°C per minute. Hold at rate-of-climb elevated temperature for five minutes.

Relieving Refractory Dies — Spacer Technique

1. Whether the refractory model has only been partially degassed in the burnout furnace or completely degassed in the vacuum furnace, allow it to cool to room temperature, then submerge completely in water for 3–4 minutes (until no further air bubbles can be seen rising from the model). Place the soaked model on a damp sponge to allow excess water to drain off.
2. Mix a small quantity of refractory powder and liquid on a glass slab to a creamy consistency.
3. Apply spacer to the refractory model or die with a brush. Apply to the central area of the preparation, and if the preparation includes lingual and incisal reduction, spacer should be applied to these areas as well. Be sure to leave about 2 mm immediately adjacent to the margins free of spacer to ensure proper adaptation of the final restoration. A single coat of spacer usually provides adequate relief for the bonding agent or cement.
4. Proceed with the porcelain vacuum furnace firing cycle using the following parameters:

Firing Spacer During Final Degassing (Preferred Technique)

Use a drying cycle of 6 minutes with the furnace idling at 1,200°F/650°C. Fire with vacuum pump operating from 1,200°F/650°C to 1,950°F/1,065°C with a final hold time of 2 minutes. Use a rate-of-climb of 100°F/55°C per minute. No special cooling cycle is necessary.

Firing Spacer Separately (Alternate Technique)

Use a drying cycle of 6 minutes with the furnace idling at 1,200°F/650°C. Fire in air from 1,200°F/650°C to 1,800°F/980°C with no hold time. Use a rate-of-climb of 100°F/55°C per minute. No special cooling cycle is necessary.

5. Allow the model to cool to room temperature, and proceed with the porcelain application technique.

Porcelain Application

1. If removable dies are being used, seal the area adjacent to the prepared die(s) by applying a material such as Whip Mix P.D.Q. HARDENER to prevent moisture from being absorbed from the porcelain during the build-up.
2. Soak the full refractory model or removable dies in distilled water for 3–4 minutes (until no further bubbles can be seen arising from the refractory).
3. Mix body (dentin) porcelain with distilled water to a thin slurry consistency to prepare a sealing application. Apply to the refractory die or model at a thickness of no more than 0.2 mm.
4. Fire under vacuum in the porcelain furnace using the porcelain manufacturer's recommended times and temperatures. Remove the model, and allow to cool.
5. Mix body and incisal porcelain separately to a normal consistency, and proceed with the porcelain buildup. Use a soft brush to remove excess moisture. Contour to desired shape.
6. Fire under vacuum in the porcelain furnace using the porcelain manufacturer's recommended times and temperatures. Remove the model and allow to cool.

7. Shape the fired porcelain as necessary with mounted stones or diamond burs. Clean, and add the final buildup of porcelain as necessary. If no further porcelain buildup application is needed, proceed with the glaze firing and any stain firings in air using the porcelain manufacturer's recommended times and temperatures. Remove the model and allow to cool.

Removing Ceramic Restoration from Investment

1. If using a solid model, section dies from the bulk of the refractory model with a thin separating disc.
2. Use a #6 or #8 round carbide bur with an electric handpiece to remove the remaining investment from each restoration.
3. Use an abrasive blasting pencil with 50 micron aluminum oxide abrasive or glass beads at 1.6 kg/cm² (20–25 psi) pressure to clean away any remaining investment material.
4. The final fit of the facing can now be checked on the master model. Trim any rough edges with a fine stone, diamond or silicone rubber wheel to produce a smooth margin.
5. Use a diamond polishing paste or Whip Mix R-400A Flour of Pumice to restore a glaze-like surface to the margin.

Etching

Several etching techniques and/or materials are commercially available. Follow the procedure recommended by the porcelain manufacturer. Use Whip Mix REGULAR STICKY WAX to protect glazed surfaces during the etching procedure. After etching, the restoration may be chilled in ice water to facilitate removal of the wax.

Post-Separation Corrections

If it is necessary to refire the porcelain restoration for a stain correction or porcelain addition, refractory material may be used as an investment for maintaining the dimensions of the restoration during the firing procedure.

1. Do not remove the glaze from the porcelain until the restoration has been re-invested and the investment patty has been degassed.
2. If an add-on application of porcelain is to be made, the area to be added can be waxed prior to investing so as to create a space in the investment patty for the porcelain. Use a die lubricant such as Whip Mix LUBRITEX #12 on the master die-stone model before repositioning the restoration on the stone model. Whip Mix LIFE-LIKE PRESENTATION WAX is white in color and is ideal for waxing deficient areas to be added on in porcelain.
3. Once the "add on" area has been fabricated in wax, remove veneer from the stone model block out binder cuts with wax, and apply lubricant to the inside of veneer. This will allow you to remove veneer from the refractory patty after it sets.
4. Mix a small patty of refractory powder with liquid to a consistency heavy enough to support the ceramic restoration.
5. Fill the tooth side of the veneer with investment, then place a small patty of mixed refractory on paper towel.
6. Place the ceramic restoration in the small patty positioned so that the surface to be stained or corrected is readily available.
7. Allow the investment patty to benchset for one hour. Remove the ceramic restoration with a fine instrument. Remove the investment patty from the paper towel, and trim excess.
8. Degas the investment patty in a burnout furnace from room temperature to 1,500°F/815°C with a hold time of 20 minutes at peak temperature. Remove the patty, and allow to bench cool to room temperature.
9. Place veneer back on degassed patty and proceed with corrections.

Maryland Bridge Technique

Pouring the Cast

Liquid/Powder Ratio:

V.H.T. 19mL/100g
(Special Liquid Concentrate)

Polyvest 22mL/100g
(Special Liquid Concentrate – Plus)

Excellent surface smoothness can be obtained when refractory investments are poured against all types of non-aqueous impression materials.

Alginates and most hydrocolloids should be avoided due to the chalky surfaces that may result.

Note: If a stone cast is desired, it should be poured first, then the refractory cast.

The liquid may be diluted to lessen the expansion of the investment and thus compensate for the variation in shrinkage from alloy to alloy. Pour the measured liquid into a mixing bowl, then add the weighed powder.

Mix mechanically under vacuum at slow speed (425 rpm) for the recommended time for the refractory material (Polyvest: 20 seconds/V.H.T.: 60 seconds). Spatulation at high speed is not recommended. Vibrate the refractory into the impression in the usual manner. The model may be removed after 45-60 minutes.

In practice, it will often be found that a full model is not needed. Since this model is only used for the wax-up and not the porcelain work, there often is only need for the teeth in the immediate area of the restoration. For instance, a six unit lower anterior splint needs only a model of the lower anterior teeth back to the first premolar.

In some instances, only a stone master cast is available which must be duplicated to produce the refractory cast. A silicone based duplicating material is recommended.

Waxing the Restoration

First check for undercuts on refractory model. Undercuts may be filled with investment. Mix a small amount by hand using 100% liquid. Wet the

undercut area before applying mixed investment and allow material to dry completely before proceeding with wax-up.

The wax-up can be made directly on the refractory model. This allows greater accuracy, as well as a savings of time. The procedure for wax-up on any abutments simply consists of flowing a layer of wax directly onto the model, however do not use die lube.

After the wax-up is completed, the sides of the model should be trimmed back as far as possible without cutting into the wax pattern. The base should be left about 10 mm thick for strength, particularly for long spans. The wax pattern can then be sprued, a wetting agent applied, such as Whip Mix Smoothex, dried and invested.

Investing, Burnout and Casting

Choose a casting ring or ringless system that positions the wax-up about 10 mm from the end of the ring. If the base of the die sticks out, it can be removed with a model trimmer after the investment sets. Use no other ring liner as casting fins may result.

Using the same liquid/powder ratio as the refractory model, vacuum mix the investment at slow speed for the recommended time.

Overfill the ring slightly and allow the mold to bench set for 60 minutes or more. Trim back the end of the ring and place in a cold furnace. Raise the furnace temperature slowly 20°–25° F (10°–14° C) dpm to the temperature recommended by the alloy manufacturer (1450°–1650° F). Heat soak the mold for 30 minutes at temperature and cast immediately. Devest as usual.

Note: For easier dig-out, HI-TEMP can be used as the outer investment. It is mixed according to the following proportion: HI-TEMP 16mL/100g powder.

Troubleshooting

| Problem | Cause | Solution |
|---|--|---|
| Cracking or crazing of Porcelain | Mismatch of porcelain to refractory First layer of porcelain applied too thick – improper wetting of model | Refer to CTE or compatibility chart to select proper refractory. First application should be no thicker than .2 mm. |
| Lift-Off, Peeling of Porcelain | First buildup layer of porcelain applied too thick | Use thinner buildup to control shrinkage. In distilled water soak 3–4 minutes/ till no bubbles. |
| Check Line Visible in Porcelain | Incorrect tooth preparation; avoid sharp angles. Ideal tooth preparation for facings will have a chamfered margin. | Refire porcelain to heal crack. If necessary, grind out, add new porcelain and refire. |
| Bubbling in Porcelain | Improper degassing procedure Refractory model too large Contamination Improper wetting of model | Check procedure and repeat degassing. Trim bulk of refractory model to minimum size before degassing. Check for contamination of porcelain with rubber wheels or incorrect stones. In distilled water soak 3–4 minutes/ till no bubbles. |
| Improper Fit | Incorrect powder/liquid ratio No spacer used or incorrectly applied | Always use 100% liquid for mixing refractory investment. For full crowns, use PDQ DIE PACER on master model, and duplicate with a silicone type duplicating material before pouring a refractory model. |
| Discoloration on Refractory Model (Violet) | Contaminated muffle | Purge muffle as recommended by furnace manufacturer to remove contamination. |
| Refractory Investment Setting Too Fast | Outdated material Improper storage of powder/liquid Improper powder/liquid ratio | Check date of material. Store investment in cool, dry area. Always measure powder and liquid accurately. |

No Warranty

Due to the wide variety of possible uses materials in the Whip Mix Refractory System have, and since the handling of these materials is implied, for V.H.T. INVESTMENT or POLYVEST and the liquids sold and used in connection therewith, and all other warranties expressed or implied, including the IMPLIED WARRANTY OF MERCHANTABILITY and the IMPLIED WARRANT OF FITNESS FOR A PARTICULAR PURPOSE, are hereby EXCLUDED and DISCLAIMED.

The sale of Whip Mix refractory investments does not provide the purchaser with a license to manufacture a product which may infringe a particular patent.