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2. Porcelain Primer
   Bisco
3. RelyX Ceramic Primer
   3M ESPE
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    Tokuyama/ J. Morita USA
Bonding resin to glass usually requires the aid of a silane coupling agent. These products not only initiate the chemical attraction between resin cements, for example, and a porcelain restoration, but actually help bond the glass filler particles in the resin cement to the resin matrix. They also make porcelain repairs possible. Our tests suggest that they usually increase bond strength of one composite to another, but this does not seem to apply to all composites. In the sequence of use, porcelain is either etched with hydrofluoric acid, sandblasted, or both. If hydrofluoric acid is not used, regular phosphoric acid etchant is applied for five seconds (doesn’t etch the porcelain, only changes surface chemistry), the etchant is washed off, and the porcelain is dried. Then the silane is applied.

Our tests found bond strengths were not significantly different if the silane was applied for 5 or 60 seconds before drying. The results of these tests appear in the commentary for each product.

**WARNING**

We have also found that silane can interfere with bonding to dentin. Therefore, when applying silane, use a fine brush and limit its application to the restorative material. Do not allow it to run onto the adjacent tooth structure.
Clearfil Porcelain Bond Activator
Kuraray
www.kurarayamerica.com (4.5)

Cost: $58.00/4ml ($14.50/ml)
Includes: 1 bottle (4ml)
Shelf life: 2 years refrigerated
MSDS: Included

Description
For optimal performance, it needs to be mixed with Clearfil New Bond, Clearfil Photo Bond, Clearfil Liner Bond 2V Primers A and B, or Clearfil SE Bond Primer. Hydrophobic aromatic dimethacrylate solution.

pH
2.3

Application Time
2–3 seconds.

Bond Strength to Porcelain (MPa)

<table>
<thead>
<tr>
<th>Application Time</th>
<th>Bond Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
<td>19.1</td>
</tr>
<tr>
<td>1 minute</td>
<td>20.2</td>
</tr>
</tbody>
</table>

NOTE
These results reflect using the product straight out of the bottle without mixing it with any of the recommended adhesives. When we tested it mixed with Clearfil SE Bond primer, applied it for five seconds, and then applied Clearfil SE Bond liquid (brush on/brush off), followed by light curing for 10 seconds, the bond strength of one specimen exceeded 30MPa, while others fractured the porcelain.

RAVES & RANTS

Doesn’t need HF
Only requires five second application
Must be mixed for maximum performance
Extra components not included

Packaging
Non-resealable plastic bag with a notch to make opening easier. One side of the bag is clear and has a label with the expiration date and lot number, while the other side is opaque with only the product name. The expiration date is printed directly onto the translucent squeeze bottle.

Directions
Plain paper sheet with instructions for use with various Kuraray products. Includes instruction to refrigerate the product when it is not in use.
Porcelain Primer
Bisco

**Description**
Fully hydrolyzed, no mix, active straight from the bottle.

**pH**
5.9

**Application Time**
60 seconds.

**RAVES & RANTS**
- Least expensive
- Highest no-mix bond strength
- Needs 60 seconds for optimal performance
- Opaque bottle doesn’t allow viewing remaining contents

**Cost:** $16.00/10ml ($1.60/ml)
**Includes:** 1 btl (10ml)
**Shelf life:** 2 years
**MSDS:** Included

**Bond Strength to Porcelain (MPa)**

<table>
<thead>
<tr>
<th>Application Time</th>
<th>Bond Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
<td>25.3</td>
</tr>
<tr>
<td>1 minute</td>
<td>29.9</td>
</tr>
</tbody>
</table>

**Packaging**
Opaque white plastic squeeze bottle in a non-resealable plastic bag. The label is moisture-resistant and includes the expiration date, which is also imprinted on the bag.

**Directions**
Plain paper foldout, straightforward information.

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RelyX Ceramic Primer
3M ESPE

**Description**
Fully hydrolyzed, no mix, active straight from the bottle. Ethanol solution.

**pH**
4.6

**Application Time**
5 seconds.

**RAVES & RANTS**
- Standard-bearer
- Track record second to none
- By far, the most expensive
- Why no sandblasting?

**Cost:** $120.60/5ml ($24.12/ml)
**Includes:** 1 btl (5ml)
**Shelf life:** 3 years
**MSDS:** Not included

**Bond Strength to Porcelain (MPa)**

<table>
<thead>
<tr>
<th>Application Time</th>
<th>Bond Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
<td>21.4</td>
</tr>
<tr>
<td>1 minute</td>
<td>22.1</td>
</tr>
</tbody>
</table>

**Packaging**
Small plastic squeeze bottle with integral dropper packaged in a non-resealable plastic bag. Printing on squeeze bottle is resistant to disinfectant dissolution. Expiration date is printed on the bottle as well as on the plastic bag.

**Directions**
Plain paper printed in 11 languages, annoying foldout design. Information, however, is straightforward and current, but does not mention sandblasting.
**Silanator**

*Cosmedent* 4a

- **Description**: Fully hydrolyzed, no mix, active straight from the bottle.
- **pH**: 7.5
- **Application Time**: 5 seconds.
- **Bond Strength to Porcelain (MPa)**
  - 5 seconds: 19.4
  - 1 minute: 19.1
- **Packaging**: Glass bottle in Ziploc bag. Mylar-coated label includes the expiration date.
- **Directions**: None.
- **RAVES & RANTS**
  - Almost least expensive
  - No frills
  - Glass bottle has to go
  - No directions?

- **Cost**: $17.00/10ml ($1.70/ml)
- **Includes**: 1 btl (10ml)
- **Shelf life**: 2 years
- **MSDS**: Not included

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**Silane**

*Ultradent* 4b

- **Description**: Fully hydrolyzed, no mix, active straight from the syringe.
- **pH**: 5.3
- **Application Time**: 5 seconds.
- **Bond Strength to Porcelain (MPa)**
  - 5 seconds: 17.4
  - 1 minute: 17.3
- **Packaging**: Clear plastic box with a clear plastic lid. Printing on the syringe is resistant to aggressive disinfection. The expiration date is on the label of the package as well as on the syringe in Ultradent’s confusing secret code.
- **Directions**: Plain paper foldout, several black and white photos, short, simple and easy to understand. Combined with the instructions for Porcelain Etch — silane is only mentioned in passing.
- **RAVES & RANTS**
  - Syringe packaging more convenient
  - Inexpensive
  - No tips with kit
  - Directions barely mention product

- **Cost**: $12.99/2.4ml ($5.41/ml)
- **Includes**: 2 syringes (1.2ml ea)
- **Shelf life**: 3 years
- **MSDS**: Included

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The Ratings 1107
**Silane Bond Enhancer**

**Pulpdent**

**Description**
Fully hydrolyzed, no mix, active straight from the syringe.

**pH**
6.3

**Application Time**
1 minute.

**Bond Strength to Porcelain (MPa)**

<table>
<thead>
<tr>
<th>Application Time</th>
<th>Bond Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
<td>18.9</td>
</tr>
<tr>
<td>1 minute</td>
<td>20.1</td>
</tr>
</tbody>
</table>

**Packaging**
Syringes in clear plastic tray with slide-off paper top that includes the directions. The supplied syringe tips are red plastic with a rather large orifice that allows you to dispense one drop at a time, but does not have the precision of the various tips from Ultradent. There is also no expiration date on the syringes, only on a sticker on the bottom of the tray.

**Directions**
Inside slide-off cover. Directions are in five languages and includes the MSDS. Short, straightforward, easy to understand. But there is no specific time to leave it on the porcelain.

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**Silane Primer**

**sds/Kerr**

**RAVES & RANTS**
- Good track record
- Doesn’t require bonding resin with cement
- Still need bonding resin with thick composite
- Opaque bottle doesn’t allow view of contents

**Description**
Fully hydrolyzed, no mix, active straight from the bottle.

**pH**
7.3

**Application Time**
1 minute.

**Bond Strength to Porcelain (MPa)**

<table>
<thead>
<tr>
<th>Application Time</th>
<th>Bond Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
<td>17.6</td>
</tr>
<tr>
<td>1 minute</td>
<td>21.3</td>
</tr>
</tbody>
</table>
**Packaging**
Black plastic squeeze bottle with screw-on red cap in non-resealable plastic bag. Label is moisture-resistant and has the expiration date.

**Directions**
Very small sheet of coated paper, 12 languages. Short, concise, maybe too brief. Doesn't tell you how long it should remain before you move to the next step.

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**Description**
2-part silane that presumably doesn't require pre-etching with HF.

**pH**
2.0

**Application Time**
10 seconds.

**Bond Strength to Porcelain (MPa)**

<table>
<thead>
<tr>
<th>Application Time</th>
<th>Etched with HF</th>
<th>Bond Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
<td>No</td>
<td>18.9</td>
</tr>
<tr>
<td>5 seconds</td>
<td>Yes</td>
<td>21.3</td>
</tr>
<tr>
<td>10 seconds</td>
<td>No</td>
<td>19.3</td>
</tr>
<tr>
<td>10 seconds</td>
<td>Yes</td>
<td>22.2</td>
</tr>
</tbody>
</table>

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**Packaging**
Cardboard box with flip top that is hinged in the rear. Cardboard insert holds the two bottles of silane. Expiration date is printed on the box and on the bottles, which are color-coded: Primer A is light green, while Primer B is teal.

**Directions**
Annoying plain paper foldout in six languages. Advises that no etching of any type is necessary and that 10 seconds is the requisite application time.

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**Tokuso Ceramic Primer**
Tokuyama/J. Morita USA

Cost: $56.00/10ml ($5.60/ml)
Includes:
- 1 btl of Primer A (5ml)
- 1 btl of Primer B (5ml)

Shelf life: 3.5 years refrigerated

MSDS: Included

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**RAVES & RANTS**

- 10-second application OK
- Can use without etching in a pinch
- Need to mix
- Works better with HF

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Clearfil Porcelain Bond Activator can be used solely or mixed with some of its brandmates. Its performance as a single bottle is adequate, but when mixed as directed, its bond strength is significantly better than the rest of the products in this category.

Porcelain Primer stands out by having the lowest cost and the highest bond strength by a no-mix product. However, it requires a 60 second application to achieve optimal performance.

RelyX Ceramic Primer, which used to be Scotchbond Ceramic Primer and was originally known as Scotchprime, has been a reliable performer over the years. It has the research and the track record. However, it is, by far, the most expensive in the category.

Silanator performed adequately in our tests, but the glass bottle has got to go.

Silane is very convenient in its syringes. However, its bond strengths were slightly below the others in this group.

Silane Bond Enhancer is also very convenient in its syringes, but the large red tips are not very precise.

Silane Primer, which also has a long track record, features a resin base, which presumably eliminates having to apply an unfilled resin to the silane-treated porcelain surface prior to the resin cement. In this case, the resin base wets the surface of the porcelain adequately to negate the need for the additional resin wetting agent. However, our own tests have found this wetting is not adequate for repairs when a thick composite is used — you still need to use an unfilled resin after the silane.

Tokuso Ceramic Primer is the only product in this category other than Clearfil Porcelain Bond that needs to be mixed. While it is presumably not necessary to apply any type of etchant to treat the porcelain prior to application, our tests showed pre-etching with HF increases its bond strength about 15%. Whether this increase is enough to make any clinical difference is not known. On the other hand, it is reassuring to know that if you can't etch for whatever reason prior to applying this product, it will still perform reasonably well.

OTHER PRODUCTS IN THIS CATEGORY

CerinatePrime
Den-Mat
Fusion
George Taub

Monobond-S
Ivoclar Vivadent
Porcelain Silane
Premier

Prolong Silane Bond Enhancer
Mirage
Silane Porcelain Primer
Sultan