



PREMISE™

Universal Trimodal Nano Composite

Technical Bulletin

PREMISE, a universal nano-filled restorative material, offers high polish, excellent mechanical strength and low polymerisation shrinkage, all in one system. For all shades, except Super Clear, three differently sized fillers are used to achieve very high volume loading (69%), providing unmatched handling and gloss characteristics¹. For the Super Clear shade, nanoparticles are used as fillers.

MATERIAL COMPOSITION

All Enamel, Dentine, Packable and three of the Translucent shades consist of:

- Trimodal filler system-
 1. Pre-Polymerised Filler (PPF), 30 to 50 μm
 2. Barium glass, 0.4 μm
 3. Silica nanoparticles, 0.02 μm
- Resin-
 1. Ethoxylated bis-phenol-A-dimethacrylate
 2. Triethylene glycol dimethacrylate (TEGDMA)
 3. Light-cure initiators and stabilisers
- Polymerisable organophosphate dispersant

Super Clear shade:

The Super Clear shade is highly loaded (75% by weight) with an extremely high translucency (70%) and consists of:

- A mixture of 0.02 and 0.04 μm silica nanoparticles
- Resin-
 1. Ethoxylated bis-phenol-A-dimethacrylate, urethane dimethacrylate and diluent monomers
 2. Light-cure initiators and stabilisers



¹ All particle sizes stated are averages

PHYSICAL PROPERTIES

Product: PREMISE	A3 Body	A3 Packable
Lot No.	338DN144	338DN145
% Volumetric Shrinkage	1.66	1.4
% Axial shrinkage @60sec	1.60	1.50
Flex. Strength (MPa)	128	137
Flex. Modulus (MPa)	10185	10981
Fracture Toughness (m1/2MPa)	1.32	1.4
Comp. Strength (MPa) 3 x 5mm	354	406
Diametral Tensile Strength (MPa)	59	56
Vickers Hardness	599	649
Depth of Cure (DOC) mm ISO method	4.3	4.2

SHADES

Enamel – A1, A2, A3, A3.5, A4, B1, B2, B3, B4, C1, C2, C3, C4, D2, D3, D4

Dentine – A2, A3, A3.5, A4, B1, B2, C2, D2

Packable – A3, A3.5, A4

Translucent – Amber, Grey, Clear, Super Clear

THE TRIMODAL APPROACH WITH PREMISE

Bringing technological advancement to all aspects of the direct restorative challenge - handling, polish, strength and polymerisation shrinkage - was the primary goal during the development of PREMISE.

Reducing polymerisation shrinkage was one of the most difficult challenges. Our strategy was to optimise the particle distribution in order to achieve the highest possible filler loading.

This was accomplished by incorporating two new fillers along with our patented barium glass, 0.4 µm. The new fillers used are:

- Non-agglomerated 'discrete' silica nanoparticles, 0.02 µm
- Pre-Polymerised Filler (PPF), 30 to 50 µm

The nanofiller, 0.4 µm filler and PPF work together to provide three main benefits:

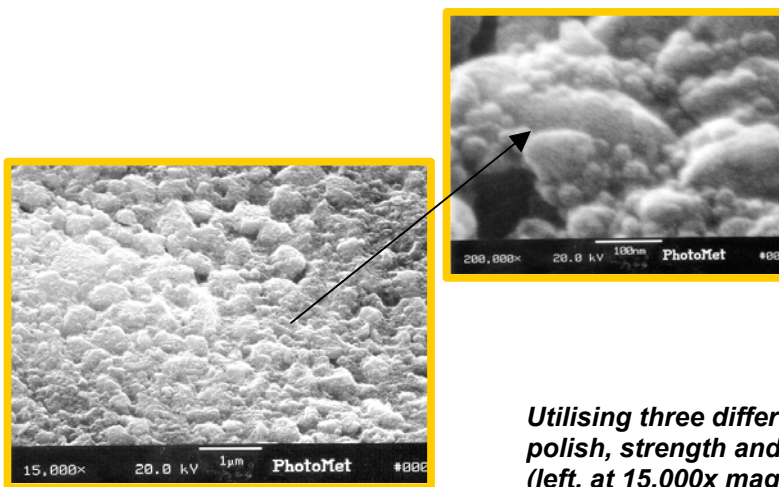
- Exceptional ease of polish and gloss during service in the oral environment
- Enhanced handling characteristics
- Decreased polymerisation shrinkage

Gloss

In traditional hybrid composites, the filler size (approximately 0.4 to 1 μm average) dictates a certain wear characteristic that, while acceptable, still offers room for improvement. During the life of a hybrid, these inorganic filler particles become detached from the resin matrix because of wear or 'plucking'.

Over time, this effect results in loss of lustre and causes the composite restorative to look dull, or even 'frosty'. In 1999, in order to address the issue of polish, Kerr introduced Point 4, with an average particle size approximately one-half that of traditional hybrids. Point 4 composite contains 0.4 μm barium glass as the main filler component.

With this advancement, polish at placement and at subsequent recalls was greatly improved².



Utilising three different types of fillers, PREMISE provides polish, strength and greatly decreased polymerisation shrinkage (left, at 15,000x magnification and right, at 200,000x)

PREMISE builds on the proven success of Point 4 by using the same 0.4 μm barium glass filler along with discrete 0.02 μm nanoparticles as the only inorganic filler components. The discrete nature of the incorporated nanoparticles results in a material with enhanced polishability and gloss.

Handling

Like the smoothness of movement that roller bearings provide machinery, nanofillers provide their own 'roller-bearing' effect when dispersed among the other filler types, giving PREMISE a non-sticky and smoothly sculptable handling characteristic. PPF particles, due to their larger size, minimise inter-particle associations, in turn reducing stickiness. The 0.02 μm nanoparticles are so small that each one is comparable in size to about 100 individual resin molecules.

² Gloss values after abrasion measured both at Kerr Dental Materials Center as well as outside research facilities showed nearly identical values to the gloss values of microfills.

Shrinkage

Shrinkage in a composite is caused by the change in dimensions as the resin cures since molecules come together to form bonds with each other. Therefore, the lower the proportion of resin (higher proportion of filler or higher loading) in a composite, the lower the shrinkage will be.

Composite materials that claim ultra-low shrinkage values typically use large-particle fillers to get a high loading. However, this also results in poor polishability and non-retention of lustre during clinical use.

Composite materials that contain only agglomerated silica nanoparticles (microfills) show excellent polish characteristics but loading is limited because of their small particle size. To improve handling and physical properties, microfills also contain their own PPF. The PPF in microfills, however, contains only agglomerated silica nanoparticles. Since they contain no other inorganic fillers except nanoparticles, microfills offer high polish, but are typically weaker than hybrids and are usually not radiopaque. This limits their use for posterior restorations.

In PREMISE we took the approach of incorporating a PPF that acts as a large-particle filler to give it physical properties equivalent to a hybrid.

This PPF is composed of cured resin loaded to 81% with submicron fillers. The composition of the PPF in PREMISE is very similar to the final paste: barium glass and silica nanoparticles with an average particle size of 0.4 µm and resin.

Since the particles are so small in size, we also incorporate nanosilica of 0.02 µm as the third filler component, which can act as a quasi-liquid (or nanomer).

SUMMARY

Used in combination, 0.4 filler, nanofillers and PPF work to provide high overall loading, microfill-like wear characteristics and predictable, non-sticky handling.

The following is a summary of the features and benefits achieved from the Trimodal approach used in PREMISE:

PPF (Pre-Polymerised Filler)	
Feature	Benefit
Increased filler loading	Decreased shrinkage
Large particle size	Enhanced handling
Microfill-like wear	Predictable and long-lasting polish
Nanofiller	
Feature	Benefit
Increased filler loading	Decreased shrinkage
Small particle size	Enhanced polish
'Roller-bearing' effect	Enhanced handling