

# Filtek™ Z250 XT

## Nano Hybrid Universal Restorative



## Technical Data Sheet

### Indications

- Direct anterior and posterior restorations including occlusal surfaces
- Core build-ups
- Splinting
- Indirect restorations including inlays, onlays and veneers

### Shades

The shading system of Filtek™ Z250 XT Nano Hybrid Universal Restorative is based on the Vitapan® Classical Shade Guide. A simplified set of shades was selected to cover most dentists' everyday needs.

Shades A1, A2, A3, A3.5, A4, B1, B2, B3, C2 and D3, with two dentin-like shades, OA2, OA3.

### Product Description

Filtek™ Z250 XT Nano Hybrid Universal Restorative is a visible light-activated nanohybrid composite designed for use in both anterior and posterior restorations. A dental adhesive is used to permanently bond the composite to the tooth structure. It is available in 12 shades, two of which are Opaque. All shades are radiopaque and fluorescent. It is packaged in syringes and capsules.

# Composition

The performance of a composite material is largely dependent upon the fillers it employs. Generally, a composite that has smaller particles is more polishable and retains its polish better than one containing larger particles. Also, generally a composite with a higher filler loading provides stronger mechanical properties. Four broad classifications are used to describe composites: Microfills, Nanofills, Microhybrids and Nanohybrids.

## Microfills

Microfills, with their small particles, are known for their polishability and polish retention. But with the large surface area of the small particles, high filler loadings and the associated strength benefit have been unattainable, making microfills only suitable for low load-bearing, usually anterior applications.

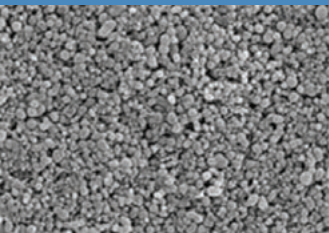
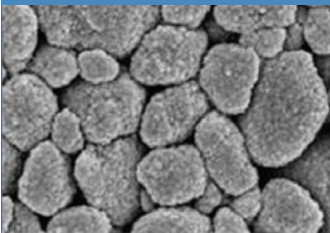
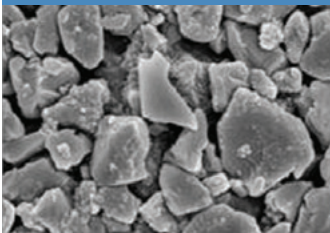
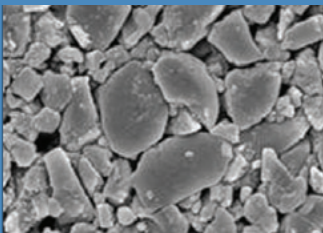
## Nanofills

3M ESPE is the only company with a product in the nanofill category. Filtek™ Z350 XT Universal Restorative, the latest offering, has a unique combination of nano-sized particles and nanoclusters. A high filler loading of nano-sized particles is achieved with this system, and the true nanofillers deliver both strength and esthetics.

## Microhybrids and Nanohybrids

Microhybrids and nanohybrids contain a mix of larger particles and smaller sub-micron sized particles. Particle size on average is typically below 1 micron but above 0.2 microns. A wide distribution of particle sizes can lead to a high filler loading with resultant high strength and wear resistance.<sup>1</sup> More recently, the description “nanohybrid” has been marketed. The distinction between microhybrids and nanohybrids is not always clear, perhaps due in part to how they are marketed. After all, even microhybrids contain a small fraction of nano (sub 100 nanometer) sized particles. Companies add nanoparticles to microhybrids to fill the resin gaps between the larger particles. This can result in improved esthetic performance. There is, however, a limit to the amount of nanoparticles that can be added before the handling becomes too stiff. It is worth noting that both microhybrids and nanohybrids contain larger particles than nanofills or microfills, and are therefore inherently limited in the esthetics that can be achieved. However, because they offer good overall performance and versatility, usually at a reasonable cost, they are a popular choice for dentists. A summary of composite classifications is given in Table 1.

**Table 1: Composite Classification Summary**

Microfill	Nanocomposite	Nanohybrid	Microhybrid
			
<p>Sub-100nm particles Discrete Non-discrete (fused) Pre-polymerized</p> <p>High surface area: High polish retention</p> <p>Low filler loading: Low strength</p>	<p>Sub-100nm particles Discrete* Non-discrete (fused) nanocluster</p> <p>High surface area: High polish retention</p> <p>High filler loading: High strength</p> <p>*Treated to bond to resin</p>	<p>Sub-100nm to micron-sized particles Average particle size tends to be slightly lower for nanohybrids (though many exceptions) Contain large amounts of ground particles</p> <p>Low surface area: Intermediate to low polish retention</p> <p>High filler loading: High strength</p>	

1. Filtek™ Z350 XT Universal Restorative Technical Product Profile, 3M ESPE

# Composition

## The Filler System

- Surface-modified zirconia/silica with a median particle size of approximately 3 microns or less
- Non-agglomerated/non-aggregated 20 nanometer surface-modified silica particles
- The filler loading is 82% by weight (68% by volume)

The filler technology of Filtek™ Z250 XT Nano Hybrid Universal Restorative is a unique hybridization of particles, including engineered nanoparticles. See Figure 1. It was derived from the Filtek™ Z250 Universal Restorative filler system, known for its excellent handling and strong mechanical properties. With the goal of achieving a better performing, more esthetic nanohybrid composite, the Filtek Z250 restorative filler system was improved with the addition of proprietary nanoparticles and nanoclusters which are bound in the resin matrix. The result is an optimized nanohybrid composite that offers great, non-sticky handling with a favorable consistency that holds its shape without slumping prior to curing. This unique combination of fillers makes the system easy to polish with good polish retention within the class of hybrids, providing predictable esthetic results. It has good mechanical properties and wear resistance for strong posterior restorations. Filtek Z250 XT Nano Hybrid restorative offers the benefits expected from a hybrid composite for both posterior restorations and anterior restorations.

## The Resin System

- BIS-GMA, UDMA, BIS-EMA, PEGDMA and TEGDMA

The resin technology is based on the Filtek Z250 restorative resin, replacing some of the TEGDMA with PEGDMA to moderate shrinkage. Filtek Z250 XT Nano Hybrid restorative composite exhibits a low shrinkage relative to competitive composites in this class of materials.

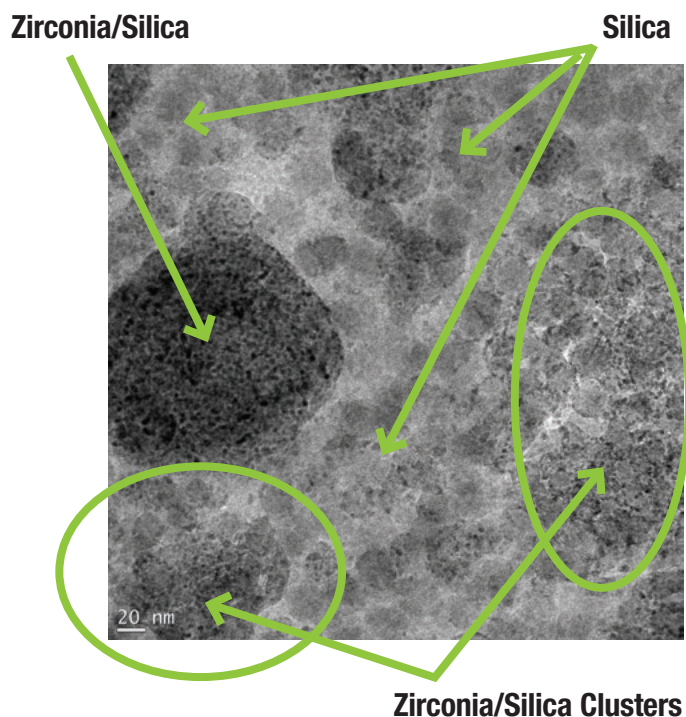
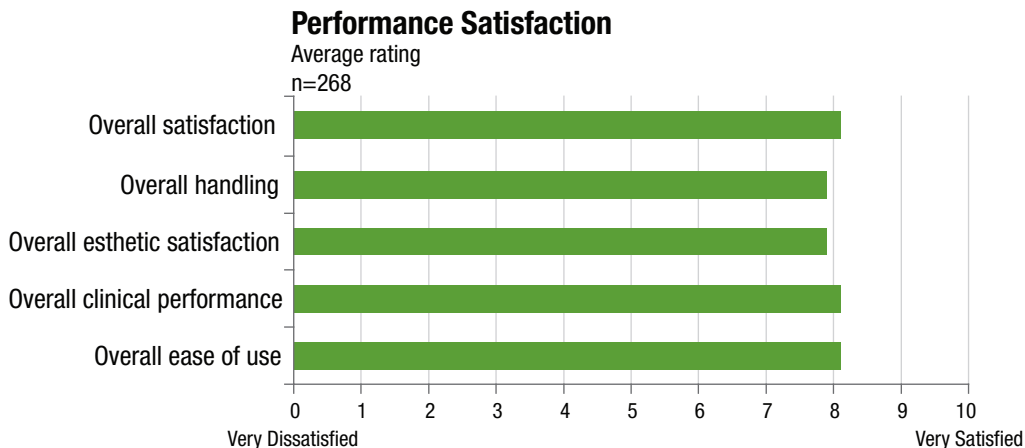


Fig. 1: Filtek™ Z250 XT Nano Hybrid Universal Restorative filler TEM at 50K magnification, 3M laboratories internal photo. Nanosilica particles and nanozirconia/silica clusters are the "Nano" portion of this nanohybrid. All filler is surface-treated to bond with resin.

# Customer Satisfaction

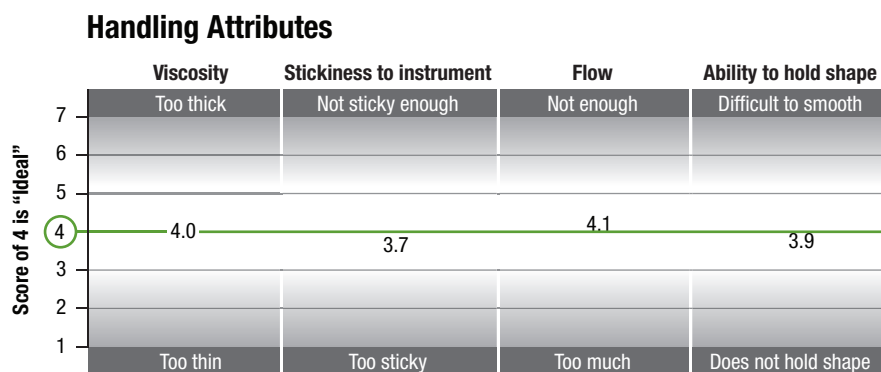
## Performance

Two-hundred sixty-eight dentists evaluated Filtek Z250 XT Nano Hybrid restorative over a period of three to five weeks, and rated it very favorably on several key attributes. The majority of dentists surveyed preferred its overall handling, giving it an average rating of 7.9 on a 10-point scale, where 0 equals “very dissatisfied” and 10 equals “very satisfied.” For Performance, Handling and Ease of Use, in vivo data on file.



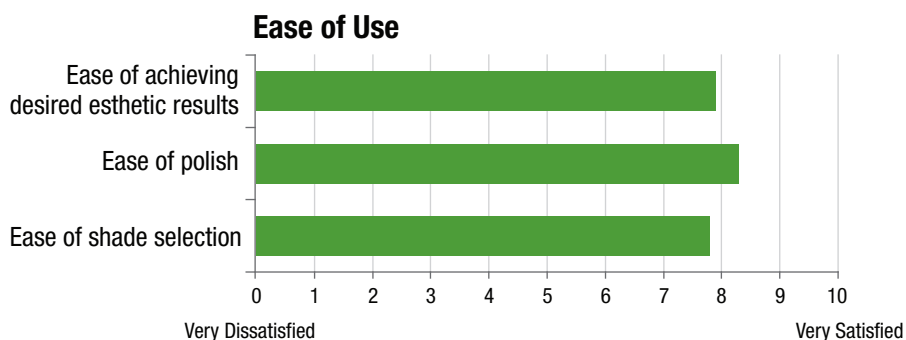
## Handling

In this same clinical evaluation, dentists found the handling to be suitable for both anterior and posterior restorations, and rated it very favorably. They were asked to rate the handling attributes on a 7-point scale—for Viscosity, Stickiness, Flow and Ability to Hold Shape—with a rating of 4 being ideal.



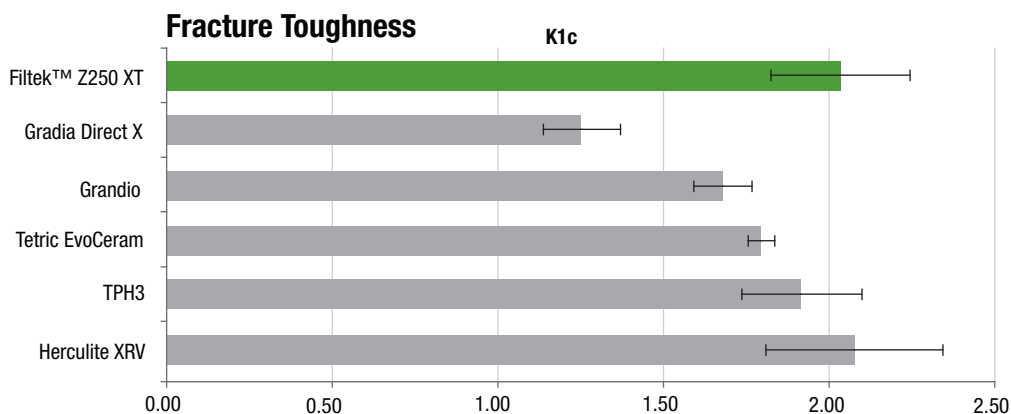
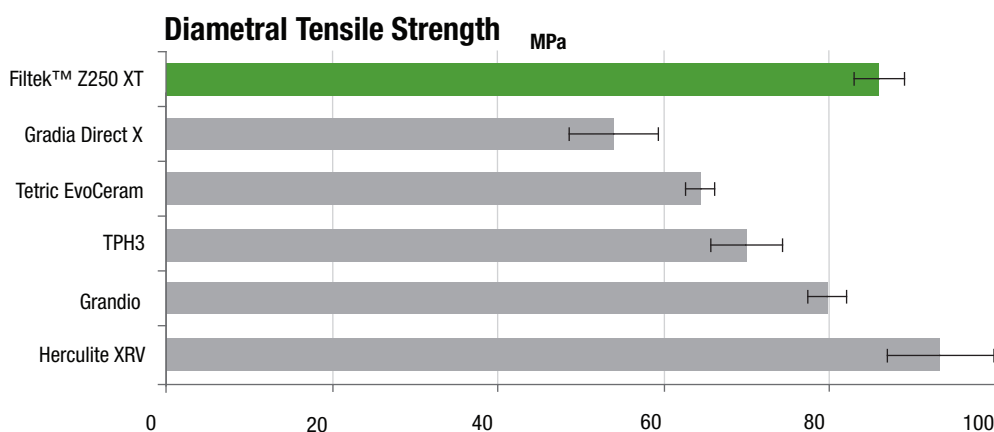
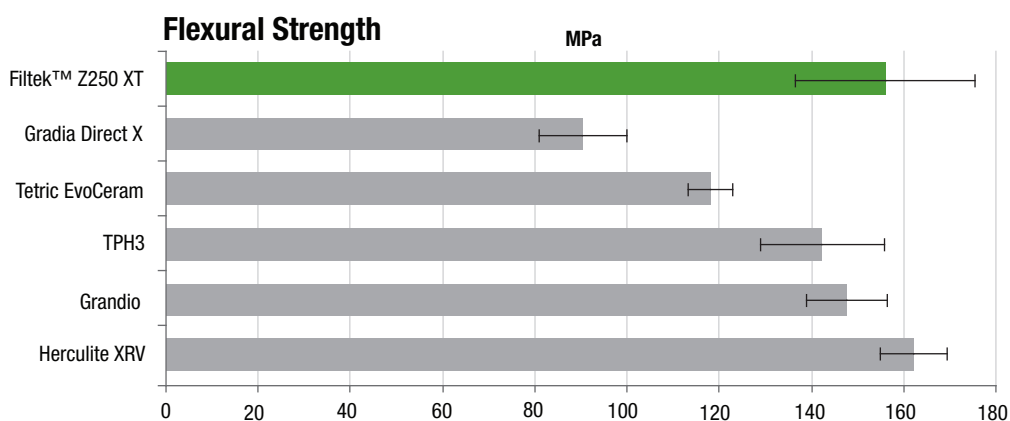
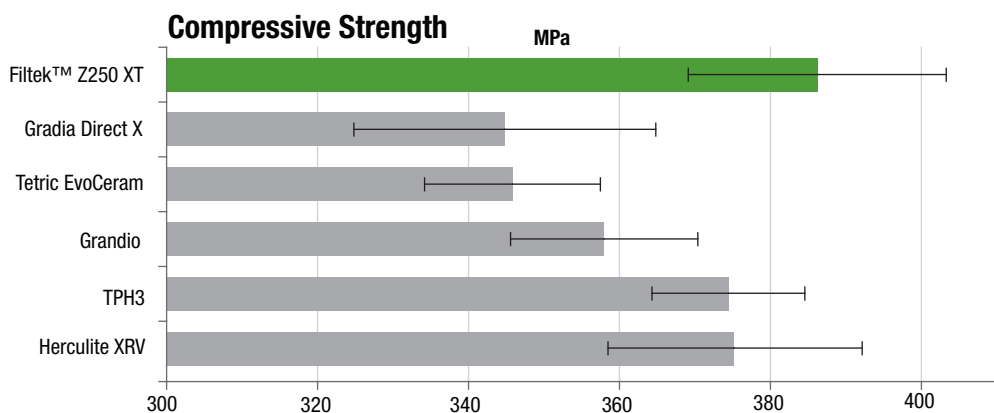
## Ease of Use

Nanohybrid composites are popular because they are versatile and easy to use. Factors that can affect the ease of use of a composite include the shading system, the polishability and the ease of achieving expected esthetic results. The Filtek Z250 XT Nano Hybrid restorative shading system was designed to match the Vita® Classical Shade Guide with 12 shades that cover most dentists’ everyday needs. Though polishability can be an issue with some hybrids, the filler package of Filtek Z250 XT Nano Hybrid restorative was specifically designed to yield a composite that is easy to polish and easy to achieve a good esthetic result. These combinations of factors make Filtek Z250 XT Nano Hybrid restorative easy to use.

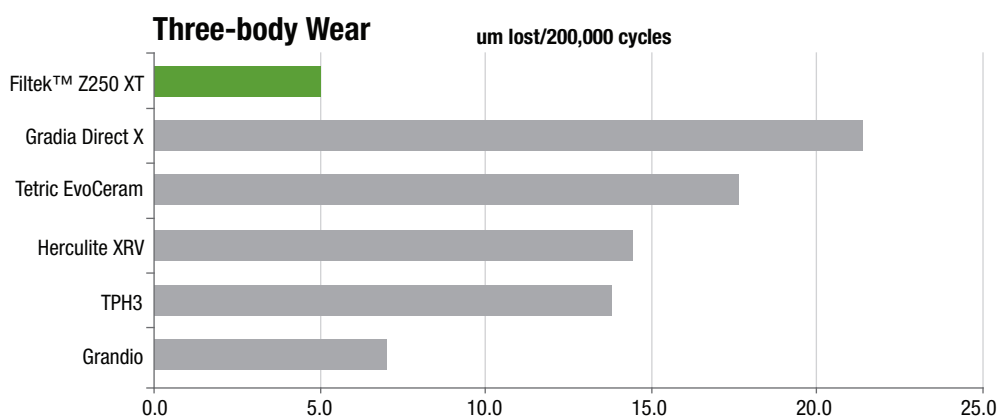
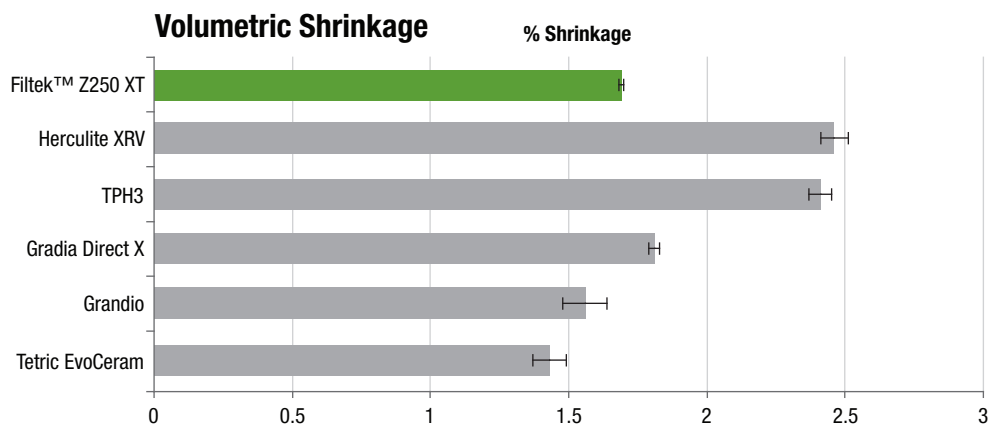


# Physical Properties

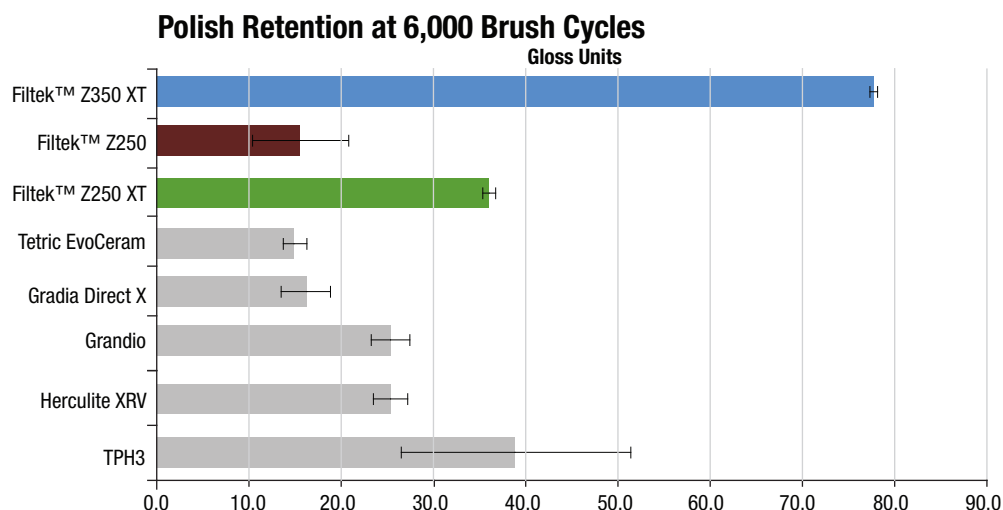
The requirements for a universal composite are challenging. Strong posterior restorations and esthetic anterior restorations with one material are not easy to achieve. Filtek Z250 XT Nano Hybrid restorative composite offers both strong mechanical properties and good esthetics relative to other hybrid composites in the marketplace. All of the following are based on 3M ESPE internal data.



# Physical Properties (continued)



Smaller filler particles make a composite more wear resistant because they leave less interparticle distance and the resin matrix is more protected. The filler design of Filtek™ Z250 XT Nano Hybrid Universal Restorative with its nanoparticles reduces the exposed resin and gives Filtek Z250 XT Nano Hybrid restorative excellent wear resistance.



Historically, a weakness of hybrids with their relatively large particle sizes has been polish retention. Only true nanocomposites such as Filtek™ Z350 XT Universal Restorative deliver polish retention similar to what can be achieved with a microfill. However, within the class of hybrids, Filtek™ Z250 XT Nano Hybrid Universal Restorative with the addition of nanoparticles performs well against competition. Tiles were prepared to a high initial polish then subjected to toothbrush abrasion. The data above shows the final polish retention (gloss) after 6,000 toothbrush cycles.



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