The new ceram.x, a nano hybrid composite, is indicated for direct and indirect restorations of all cavity classes in anterior and posterior teeth. Superior handling and significantly improved physical properties are a direct result of a novel filler system based on SphereTEC, DENTSPLY’s advanced granulated filler technology:

SphereTEC™

A high filler load supports mechanical strength and reduces polymerization shrinkage of a composite. Maximum filler loads can be achieved by combining particles of different size categories, so that large particles form a pre-packed grid and smaller ones can occupy the space in between. SphereTEC allows the production of an entirely new type of pre-polymerized filler and maximization of filler load using primary particles which are smaller than 1 µm!

In contrast to conventional prepolymerized fillers, SphereTEC fillers are virtually perfectly spherical and have a distinct, microstructured surface (Figure 1).

SphereTEC fillers are produced via spray-granulation. The process roughly contains 3 steps (Figure 2). First small droplets of barium-glass particles, surrounded by activated resin and solvent are produced. Dictated by surface tension in the gaseous phase, the droplets then form spherical shapes of a well-defined size distribution and the solvent is evaporated. Finally, by travelling through hot processing zones, the resin is cured and completed, solid SphereTEC fillers are collected.

When used in the new ceram.x, the SphereTEC fillers are thoroughly impregnated with resin and fully blend in with other parts of the filler system, i.e. isolated sub-micron glass particles (Figure 4).
ceram.x: Composition and classification

In ceram.x, the SphereTEC fillers (=15 µm) are combined with non-agglomerated barium glass fillers (=0.6 µm) and ytterbium fluoride (=0.6 µm). Furthermore, the composite contains highly dispersed, methacrylic polysiloxane nano-particles, which are chemically similar to glass or ceramics. Therefore, ceram.x can be classified a nano hybrid composite with pre-polymerized fillers.

ceram.x: Handling

ceram.x exhibits thixotropic properties. Thixotropic materials tend to show a low viscous state under force and return to a previous, more viscous state after the stress has been removed. Translated to the clinical context, ceram.x can be easily extruded from the Compules® tip and adapted to the cavity walls but has on the other side a stiff, slump-resistant consistency which supports creation of the anatomic form. All this is a direct result of the novel filler system used for ceram.x. The SphereTEC fillers also reduce the amount of resin needed in ceram.x and thus the stickiness of the paste to hand instruments.

The superiority of handling was confirmed by 142 pairwise, blinded comparisons by 71 dental practitioners. ceram.x obtained a comparable rating for paste stiffness but at the same time was rated as being superior regarding its low stickiness to hand instruments and adaptability to cavity walls and margins (Figure 3).

![Fig. 2 Schematic of the SphereTEC process. From left to right: 1. Atomization of a slurry, based on finely dispersed barium glass; 2. Assuming of spherical shapes and evaporation of solvent; 3. Curing of pre-formed particles to obtain pre-polymerized, spherical fillers.]

![Fig. 3 Pairwise evaluation of paste stiffness, low stickiness to hand instruments and adaptability of composite pastes to cavity surfaces and margins by a blinded procedure: % of preference.

![Fig. 4 SEM picture of an abraded surface of ceram.x with high lighted outlines of selected SphereTEC filler particles (Latta MA 2015).]
ceram.x: Esthetics

Sub-micron particles are favorable to obtain superior esthetics and wear resistance. During finishing and polishing, the SphereTEC fillers, although ~15 µm in size, do not impede the gloss of the surface, as their sub-micron particles are removed layer-by-layer leading to even restoration surfaces after polishing (Figure 4).

Speed and quality of gloss development were investigated by Ferracane JL and Da Costa J. Regarding the time needed to reach a clinically acceptable gloss value of 40 gloss units, ceram.x reached this level in less than 20 seconds using Twist* (P), Enhance Multi (P), or Sof-Lex* (SF).

Figure 5 shows that the time to create an acceptable gloss (40 gloss units) and the maximum gloss that can be achieved depend on both the chosen composite and the used polishing system and that ceram.x achieves high gloss with all investigated polishing systems in a remarkably short time.
The distinct chameleon effect of ceram.x makes it possible that each ceram.x shade provides shade match with several VITA* shades (Figure 6). Five so-called "cloud shades" cover the whole range of the 16 VITA* classic shades. The recipe for the shade selection procedure is given in Figure 6.

**ceram.x: Wear and fracture resistance**

Wear and abrasion in the oral cavity are multifactorial processes. Therefore, wear of ceram.x was tested by different methods. As an example, the result of wear measurement in the occlusal contact area by Latta MA is shown in Figure 7: ceram.x shows a high resistance to loss of height resulting in a low depth of the wear facet.

**ceram.x: Flexural strength**

Measurement of flexural strength is considered to provide information suitable to predict the fracture resistance of a composite when used for stress-bearing posterior restorations.

As shown in Figure 8, flexural strength of ceram.x surpasses 100 MPa even under the four-point bending method preferred by the Lohbauer group. The flexural strength of ceram.x is higher compared to Filtek Supreme XTE* and Tetric EvoCeram*, but lower compared to Venus Diamond*.

**Conclusion**

Utilization of SphereTEC™, DENTSPLY’s advanced granulated filler technology, in the composition of ceram.x results in an advanced composite restorative material, which deserves your attention. Please use the next page to obtain more detailed scientific information, product samples and visual material.

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