

Case Study

The Science Behind the Surface

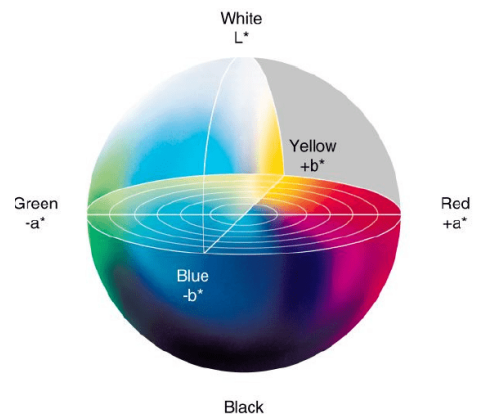
Part I

Tests, tests, and more tests. The rigorous science behind Polyvision's e³ CeramicSteel is what makes it one of the strongest, most durable surfaces in the world. Engineers and material scientists run tests on all Polyvision products, measuring everything from color correctness to impact resistance, to guarantee top-tier quality and performance.

Here we share the science behind eight of the top tests on the surface you see used in our mobile whiteboards, whiteboard wall panels, and the chalkboards & whiteboards in classrooms, offices and architectural installations worldwide.

Color Consistency

Color consistency is critical, especially when e³ CeramicSteel is used in adjacent panels where a tonal match is required or panels need to be replaced. Using a handheld spectrophotometer during production, the sample is illuminated and the reflected light spectrum is analyzed. The light spectrum is expressed in L* (light-dark), a* (green-red) and b* (blue-yellow) values. These values create a measurement more sensitive to color deviations than the human eye to ensure a true match.



Enamel Topcoat

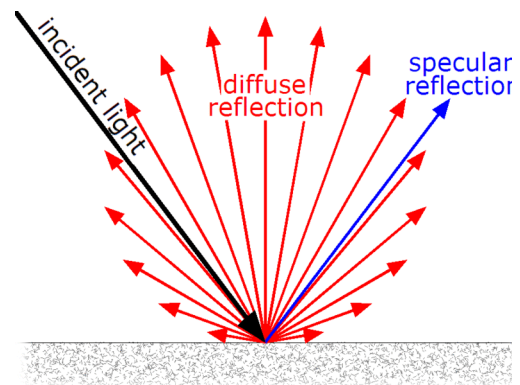
The thickness of the enamel topcoat contributes to the overall thickness of the e³ CeramicSteel, but also determines the color, coverage and texture of the board. A consistent inline thickness guarantees a consistent color and texture, which is important when making installations with multiple boards. To measure the inline thickness, a digital coating thickness gauge uses the principle of electromagnetic induction to measure the enamel topcoat. A very thin topcoat layer of 0.07 mm (2.75 thousandths of an inch) allows e³ CeramicSteel to bend up to 300 mm in diameter without forming microscopic hairlines, giving it flexibility just like glass fiber.



Gloss

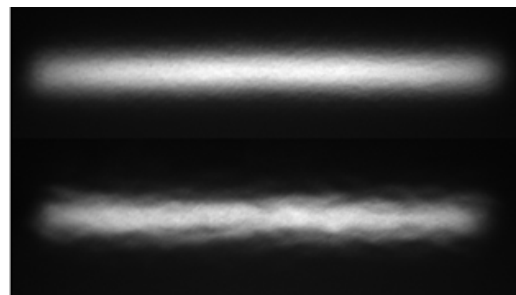
The gloss level of a surface determines the way it reflects light coming from projectors, ambient light, natural light and lighting fixtures. These reflections can be experienced differently depending on the setting, so Polyvision offers a range of gloss levels that can be suited to a specific room's configuration.

Gloss level is monitored online using a handheld gloss meter which contains one, two or three light sources. Light receptors at opposite angles measure the amount of light that has been reflected by the sample, which is a measure of the specular gloss of the writing surface.



Waviness

To finish a board, a sprayed coating is applied using pressurized air nozzles, which break the liquid coating into tiny droplets. Depending on the speed and flow behavior of the coating, this pressurized air can create a ripple in the coating, leading to a textured "orange peel" surface. A non-sprayed surface does not run the risk of this effect and exhibits a much smoother visual aspect. To guarantee a smooth surface, Polyvision boards are tested with the Byk-Gardner Wave Scan 5+ — a handheld device which is dragged over the surface while a laser beam scans the surface texture to measure inconsistencies.



The top image shows a smooth surface, while the bottom features an undesired "orange peel" texture.

The Science Behind the Surface

Scratch resistance

The scratch resistance test consists of dragging a standardized diamond needle — the hardest material on Earth — over the surface of a sample as it turns. The scratches are then colored using dry-erase markers. The ink dries and is wiped clean, to see if any of the colors remain, indicating damage. The only materials strong enough to damage CeramicSteel are those measuring more than 5 on the Mohs hardness scale, including Quartz, Topaz and Diamond.



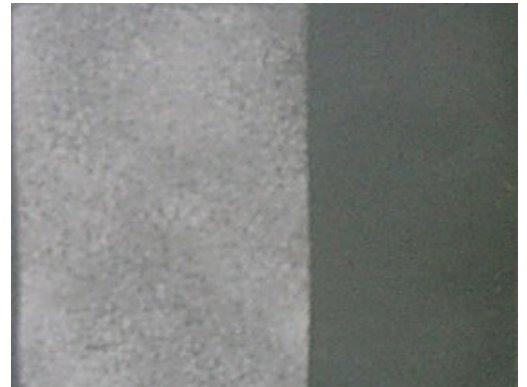
Impact Resistance

The impact test shoots a spring-loaded steel ball from a device called the Wegner pistol onto the test surface with a force of 20 newtons or 2 kilograms. Due to e³ CeramicSteel's vitreous — as hard as glass — enamel coating, Polyvision boards show high wear and scratch resistance.



Writing and Erasing of Chalk

To evaluate if an e³ CeramicSteel chalkboard surface retains sufficient chalk while being written upon, a standardized piece of chalk is dragged over the surface loaded with a 775-gram weight. Using the same color measurement as in the color consistency test, the color difference between the board and the amount of chalk on the surface is measured. The higher the measurement, the better the writeability of chalk.



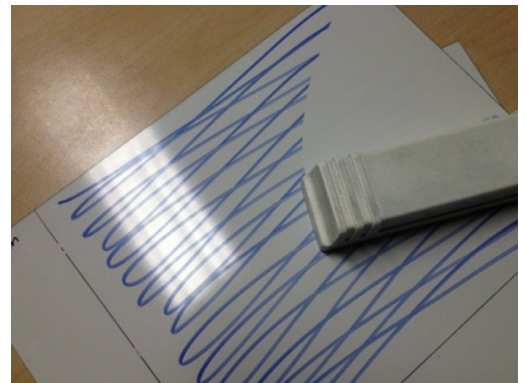
Next, the erasability of chalk is tested by erasing the chalk using a latex eraser which is also weight loaded at 760 g. Again, the color difference between the board and amount of chalk left is measured. The lower the measurement, the better the dry erasability of the chalkboard surface. Both write and erase cycles are repeated 25 times and the measurements are averaged as a final result for both writeability and dry erasability of chalk.

Erasability of Dry-Erase Markers

Erasability of a whiteboard surface is a critical property of e³ CeramicSteel. It is greatly influenced by different factors such as the cleanliness of the surface, its gloss level and the type and quality of marker and eraser used. The smoother a surface, the glossier and easier to erase it is.

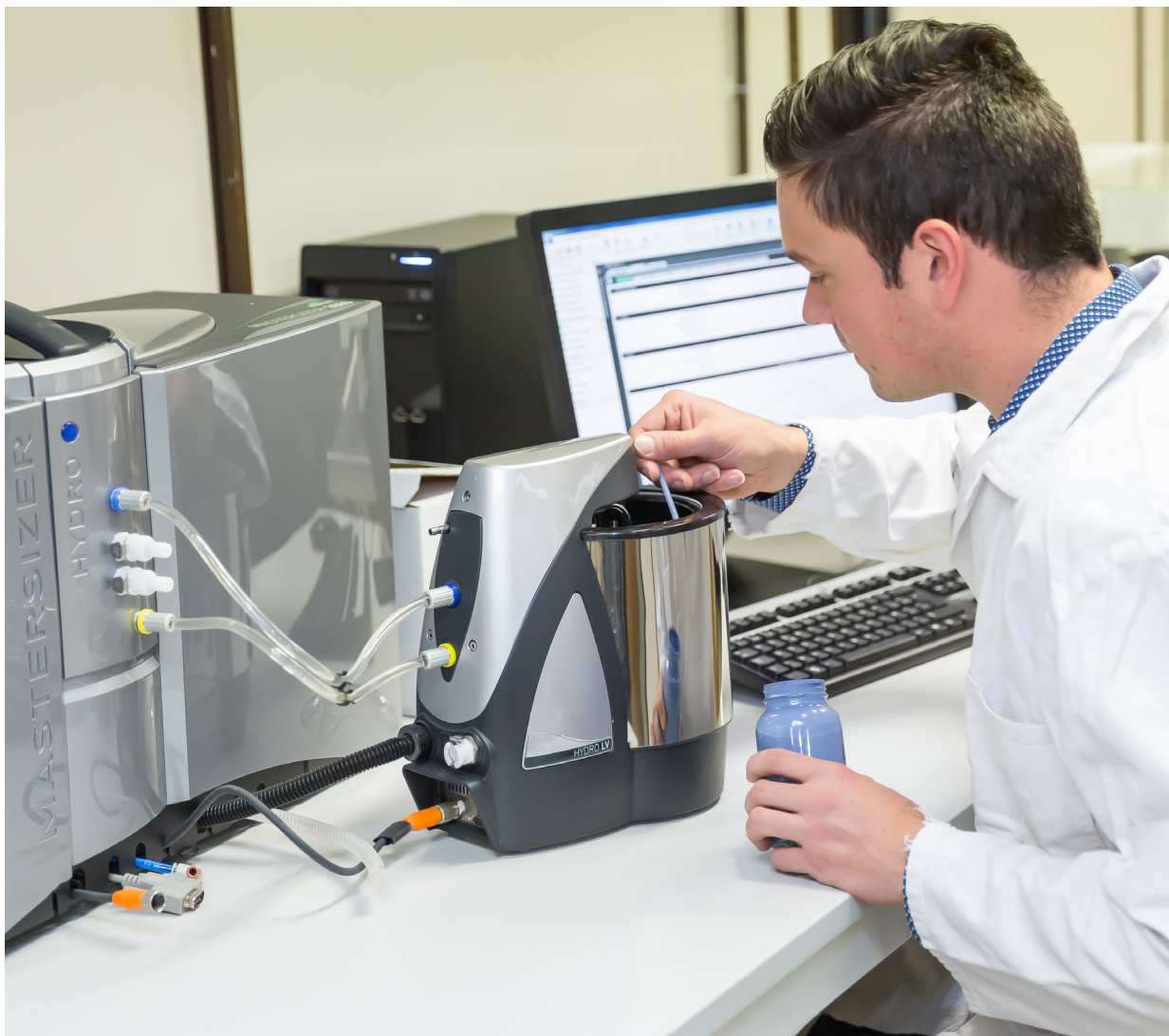
To test erasability, 10 cycles of writing on the board for 10 seconds, leaving it to dry for 10 seconds and then subsequently erasing it for 10 seconds with a felt eraser at normal hand pressure are conducted. After the 10 cycles, the more pigment that remains on the surface, the poorer the erasability is.

To learn more about the numerous tests that Polyvision conducts to provide best-in-class durability and performance, please see the whiteboard surface property whitepaper.

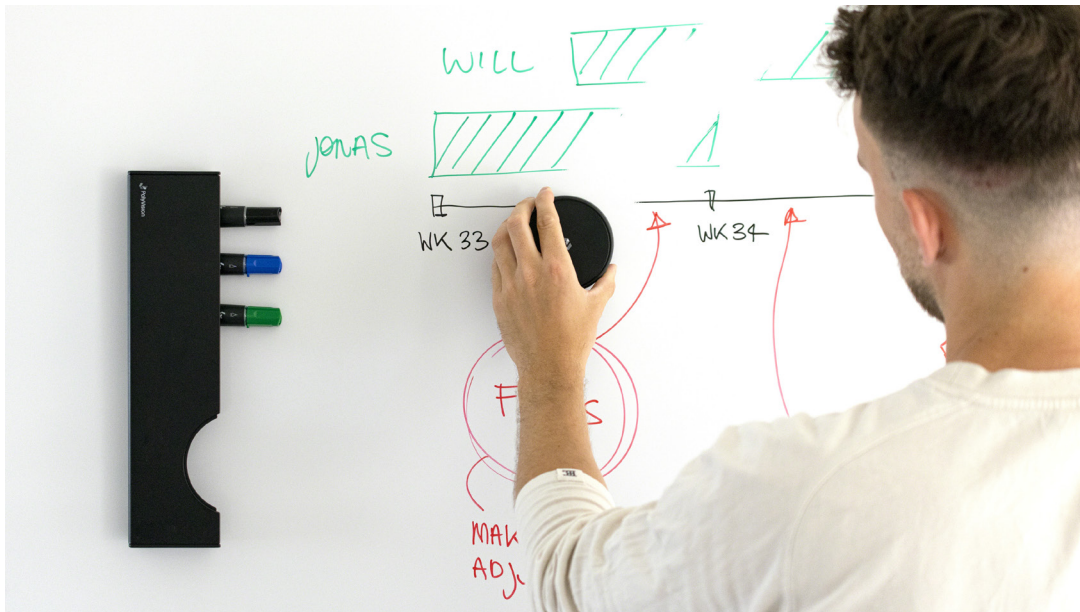


Part II

Polyvision's e³ CeramicSteel is used worldwide in projects ranging from classrooms, to public art installations and subway stations. Part I breaks down the science behind our versatile surface, explaining the rigorous tests involved before the product goes to market. But how do those tests translate to e³ CeramicSteel's market-leading performance?



The Science Behind the Surface



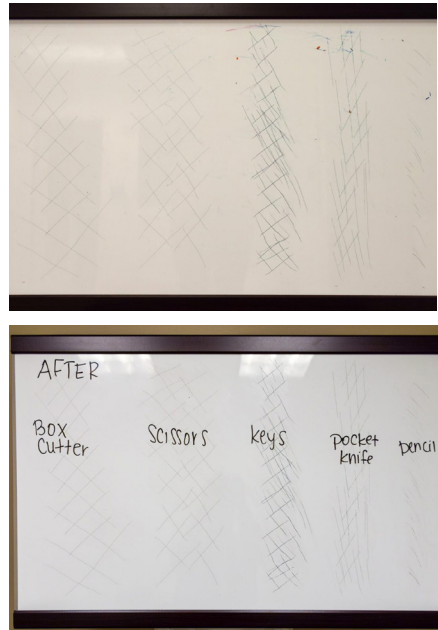
Erasability

Do you ever wonder why so many whiteboards never seem to stay white? Instead of a clean slate, a lot of whiteboards turn gray — filled with the ghosts of ideas past and unsolved formulas. All whiteboards may appear similar at first glance, but the materiality of the board's surface plays a huge role in its performance and erasability.

e³ CeramicSteel is the best material to buy if you want your whiteboard writing surface to remain white, because it combines the qualities of porcelain and steel to create a strong, nonporous surface. By testing the thickness of the enamel topcoat, we ensure the surface can handle continuous use for more than 50 years, while an erasability test guarantees you can use your whiteboard every day without pigment from markers sticking around.

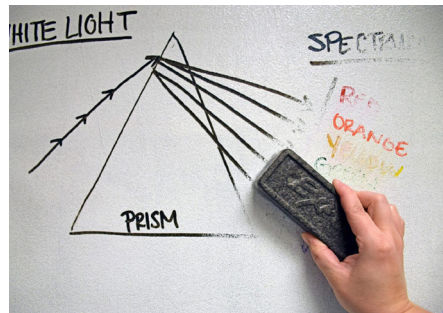
Painted Steel Dry Erase Board

On the other hand, painted steel dry erase boards will erase fine at first, but their performance deteriorates. After time, the surface becomes dull, just like the finish on any painted surface — and a dull, worn surface does not erase well. Because the surface on steel boards is paint, it is soft and porous, and this softness makes the dry erase surface easy to scratch — wearing down with extended use. As scratching occurs, ink from markers builds up causing the surface to stain and appear dirty.



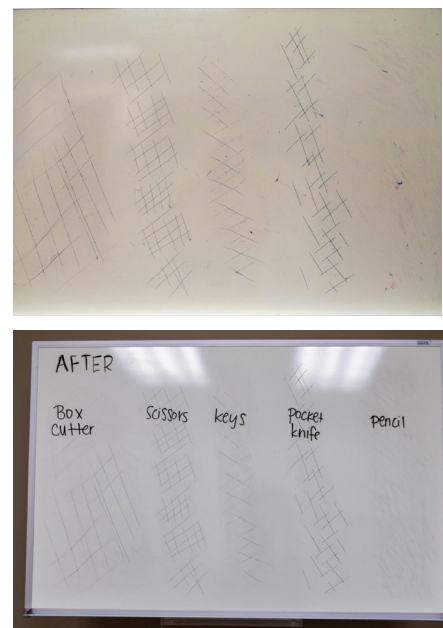
Whiteboard Paint

Other materials that don't lend well to sustained erasability are whiteboard paint and melamine. Whiteboard paint is only as strong as the surface it is painted on, making it easy to wear and damage. Paint also stains quickly and can not withstand a permanent marker if one is used by accident, instantly ruining the surface — unlike CeramicSteel whiteboards that can be easily cleaned of permanent inks.



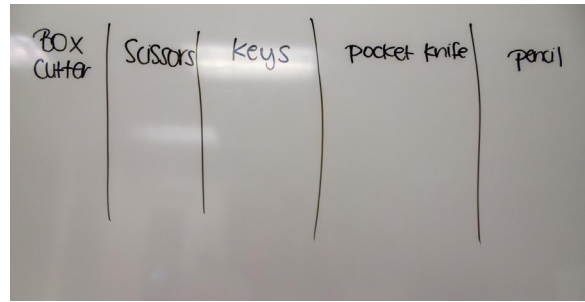
Melamine Whiteboard

Meanwhile, the most cost-effective option, melamine boards, will resist scratches better than paint. However, the plastic resin that makes up the material is malleable, prone to denting, and loses its erasability over time. Not to mention, it's not an environmentally sustainable solution. Melamine is one of the most notorious surfaces for staining and ghosting, and won't last.



CeramicSteel Whiteboard

Scratch and impact resistance tests previously discussed put CeramicSteel and other whiteboard materials through intense conditions. These include hardness scratch tests that use diamond to scratch the surface, and impact testing that fires steel ball bearings at the surface. Even with extreme force, e³ CeramicSteel maintains performance.



The Mohs Scale* of relative hardness of minerals			
	Relative Hardness Number	Reference Mineral	Hardness of Common Objects
Softest	1	Talc	
	2	Gypsum	
	3	Calcite	Fingernail
	4	Fluorite	Copper penny
	5	Apatite	
	6	Potassium feldspar	Pocketknife; glass
	7	Quartz	
	8	Topaz	
	9	Corundum	
Hardest	10	Diamond	



Exceptional Performance

The elements that make up e³ CeramicSteel create the strongest board on the market. Add to this strength the comprehensive testing done by Polyvision engineers and material scientists, and e³ CeramicSteel is proven to be the most durable, erasable and designable board in the industry. With a sturdy surface, resistance to harsh elements and a range of colors and forms, the material can't be beaten.

PART III

We've discussed in detail the differences between CeramicSteel and other common whiteboard materials, but there is one surface we haven't covered: glassboards. In recent years, glassboards have seen a rise in popularity for their modern appearance and resistance to staining — both appealing qualities. These are also qualities offered by CeramicSteel. It's a misconception that glassboards are entirely unique from CeramicSteel magnetic whiteboards or decorative dry erase boards.

While there are differences, there are just as many commonalities between the best features of CeramicSteel and glass.





Inorganic + Non-porous

Many don't realize that the dry erase surface of CeramicSteel is glass in a different form. Glass granules called frits are melted down and fused to steel sheets to create CeramicSteel. The result is a much more durable writable wall surface that is lighter in weight and opaque in color for a strong contrast when writing. Another benefit is the thin layer of ceramic fused to steel. Because the surface is thin, it's easy for magnets to penetrate, creating a functional surface with strong magnetic capabilities. On the other hand, while some glassboards are designed to be magnetic, they require rare-earth magnets to be functional. This is because the thickness required for glassboards to be safe is greater than a standard magnet can penetrate.

Both glassboards and CeramicSteel are non-porous surfaces. This prevents penetration of the surface by inks, which is why neither CeramicSteel nor glassboards will stain or ghost. They won't absorb the color from markers, leaving it on the smooth surface ready to erase. A tip for users, though. Some markers, like low-odor dry erase markers, will leave behind a greasy residue on glass and CeramicSteel whiteboards. This causes marker ink to build up over time, but it's not staining or ghosting. It's a sign that your surface needs to be cleaned with a simple solution of rubbing alcohol and water.

Chemical + Bacteria Resistance

Thanks to the non-porous and inorganic nature of both CeramicSteel and glassboards, they are both resistant to bacteria. These surfaces won't harbor bacteria or provide an environment conducive to growth. Not only that, they're both easy to clean. Glass may scratch with use from certain corrosive cleaners, but CeramicSteel is more durable, the integrity of the surface guaranteed to remain intact over the years of heavy use and cleaning. Knowing that your dry erase surface won't harbor or spread germs in the classroom or healthcare facility where students and patients are susceptible provides a little more peace of mind.

Fire Resistance

Polyvision's CeramicSteel is classified as incombustible and scores the best fire behavior rating (A1). This means that in the event of a fire, CeramicSteel will not catch fire generating additional heat or sustained flaming. Much like CeramicSteel, most glassboards are fire resistant. Dependent upon the substrate and mounting used for the respective surfaces, neither CeramicSteel nor glassboards will combust and spread fire.

Modern Aesthetics

Glassboards are often sought after solely for their aesthetic appeal. The clean, modern lines and high-end look provide something special for corporate offices, higher education spaces and specialty medical practices. CeramicSteel is commonly lumped together with other "traditional whiteboards" brought to mind from your 5th grade classroom, but that isn't the limit of CeramicSteel's design capabilities. With limitless possibilities from full-wall writing solutions to customized frameless boards, the design variety for CeramicSteel writing surfaces is expansive.

Creating a designer look with your writing surface isn't just about the surface itself, but also about what it looks like when in use. Glassboards have a higher gloss, and many users find the glare uncomfortable after time. Additionally, the distance between the transparent surface and colored background creates a drop-shadow effect that can make writing appear blurred and unclear. This isn't ideal for education, corporate or healthcare settings where information needs to be clearly communicated.



$$\begin{aligned}4(4x) + 2(x) &= 72 \\16x + 2x &= 72 \\18x &= 72 \\x &= 4\end{aligned}$$

e³ CeramicSteel

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Glassboard

Part IV

Understanding the advantages and disadvantages of different writing surfaces in the classroom can create a more productive learning environment for your students.

Today, more individuals have access to some form of classroom education than ever before. This means there are now more students and teachers filtering in and out of educational institutions who deserve whiteboard surfaces that provide clear contrast, low glare and that erase cleanly. Why does quality matter when it comes to dry erase surfaces? That's because whiteboards that underperform can create challenges for both student and educator. So, what issues can arise when a low-quality whiteboard is installed, or an inappropriate writing surface like glass is used in education?

Distraction

Dirty, stained whiteboards can be a major distraction in the classroom. The surface appears old and absorbs marker ink, leaving behind the ghosts of past math problems that simply won't erase. Low quality whiteboards like melamine, laminates, and painted steel also sustain dents and scratch easily, decreasing their usable surface area and lifespan. These issues can distract students, drawing attention away from lessons while creating obstacles for instructors to work around during lessons. CeramicSteel provides a clean, flat surface free of stains and imperfections keeps students focused on the material, not the mess.

Eye Strain

Most classes require students to take notes from the whiteboard and absorb the information presented. Concentrated focus on any surface should be comfortable with minimal strain in the classroom. Glassboards have two surfaces that reflect light. The distance between these two panes of glass creates a drop shadow effect which gives writing a blurred appearance. And, because glass is transparent, marker ink is less opaque and is harder to see on glassboards. When these issues are combined with glare from overhead lights and projectors, students can experience eye discomfort and headaches from straining to read what is written on the board. Wall-mounted whiteboards with a smooth, opaque finish like CeramicSteel create a crisp, clear contrast between dry erase markers and the surface.



Technology Incompatibility

With whiteboard materials like melamine, the bumpy “orange peel” texture discussed in past installations of this series can make it challenging for a projector to work well. This becomes an issue with glass, as well. Glare and distortion can make it impossible to use a projector properly with these surfaces. Uneven surfaces bend and distort projected images and text, while “hotspots,” or pockets of light reflected directly from the projector’s light source, can cover everything you are trying to project and make it difficult to incorporate visuals into your lectures (case in point, eye strain). These challenges caused by glare and uneven surfaces can be solved with a lower gloss whiteboard projection surface like CeramicSteel that reflects less light than standard whiteboards and glassboards.

When choosing the right surface for your classrooms, it’s important to consider the primary use of the surface. If whiteboards are planned for high-volume classrooms or spaces that will use projectors frequently, durability, low glare and technology compatibility are essential to creating the best experience for both students and teachers. Bill Livengood, Director of Surface Sales for North America shared a hands-on demonstration of these qualities at EDspaces 2019 — watch the video below to see the difference for yourself!

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