

WHITE PAPER



# New Technologies Series


## Volume 1: E Ink JustTint™

Written and produced by: Captains of Industry®

**CAPTAINS**  
of INDUSTRY

Sponsored by: E Ink Corporation®

**Eink**®



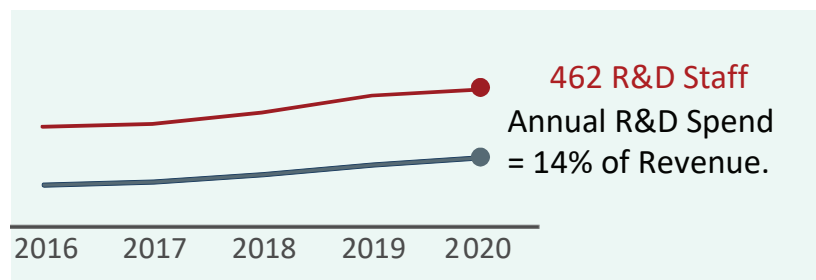
Invented in 1997 when E Ink spun out of MIT, digital paper is a technology that continues to find new applications as product developers seek to disrupt markets. Amazon's Kindle was one of the first and arguably the most well-known example of how E Ink could enable innovation on a grand scale. Flexible and ultrathin, with ultralow power consumption, digital paper has evolved to become the sustainability ingredient brand that makes every surface smart.

Today, E Ink can be seen in a broad range of products, including:

- Solar-powered transit signs that provide real-time updates.
- Easy-to-read screens on glucometers and other medical devices.
- Hospital bedside signs that improve the patient experience.
- Electronic Shelf Labels (ESLs) in retail stores that update millions of prices in seconds.
- eNote tablets for reading and handwritten note-taking.
- Digital shipping labels that can be reused endlessly.
- Digital ID badges that enhance security.

**From E Ink's corporate perspective, this is simply a good start.**

The same spirit of innovation that led to the pioneering of digital paper is now driving E Ink to reinvent what's possible. Only through a relentless focus on research and development paired with strong partnerships with product developers can E Ink's technology adapt to the needs of a changing world.



E Ink continues to build on its commitment to invest in new technologies that enable partners to create breakthrough products.

It begins by asking questions. What are overlooked problems E Ink can help solve? What types of applications can E Ink enable that will catalyze market opportunities? In this white paper, the first in a series, we highlight a new E Ink technology that answers these questions. This technology is at an advanced stage of development, with sample materials ready now to support customer prototyping and market exploration.

### **E Ink JustTint.™ The potential to democratize smart glass.**

JustTint expands the use of digital paper beyond information displays, presenting new opportunities for product developers in different industries. Within each capsule the pigment can move side to side and up and down when power is applied, essentially creating a digital shutter that controls the amount of light that can pass through the film. Simply applying the film to glass can make it smart, allowing users to have control over the level of tinting. JustTint offers fast switching capabilities between tinting levels and can be color tuned.

The power to control light is as old as the Bible (“Let there be light!”), and smart glass is not new. Various smart glass technologies, such as electrochromic solutions provided by SageGlass and others, have been successfully deployed in buildings and cars for years. Being able to control sunlight and the resulting heat gain provides significant energy-saving benefits while improving the comfort of interior spaces. The relatively high cost of smart glass and the power requirement to continually operate the shaded state, however, have often limited its use to the sleekest new buildings or luxury vehicles. JustTint has been engineered to bring the benefits of smart glass to the masses with a lower potential price tag, ultralow power consumption and the ability to retrofit existing glass.

### **Driving new levels of efficiency for Electric Vehicles (EVs).**

One of the most promising applications for JustTint identified by E Ink is the automotive sector, specifically for sunroofs. Cars made with tinted glass look cool, but more importantly, the temperature inside the cabin has a direct impact on mileage, and tinting impacts cabin temperature control. This matters for all types of vehicles but it's mission-critical for EVs.

***“Getting the cabin temperature to a comfy house-like condition draws energy from the battery that could otherwise have been used to move the car.”***

***– Charlotte Argue, Geotab***

New research<sup>1</sup> shows that when the outside temperature is below 20 F, the average driving range of an EV decreases by 41 percent. When the temperature is 95 F and air-conditioning is used the driving range decreases by an average of 17 percent. For EV drivers — and those considering switching to EVs — these are significant factors. After all, the top reason consumers avoid buying an EV is range anxiety.<sup>2</sup> Nobody wants to run out of “gas” on the side of the road, especially when EV charging infrastructure has a long way to go.

Smart glass in a sunroof allows automakers to control the level of solar heat gain, in essence creating a solar thermostat that helps keep cabin temperature at a comfortable range while preserving energy to power the car. Automakers were quick to see the benefits of smart glass in the luxury market. The McLaren 720S Spider, for example, comes with a smart glass sunroof, but with a price tag of about \$315,000 only a few captains of industry can afford one. E Ink’s JustTint, however, may provide a less pricey alternative that will bring smart glass to the average Toyota or Ford.



Sunroofs made with smart glass have until now only been available on high-end luxury cars like this McLaren 720S Spider.

One factor enabling lower cost is the ease of manufacture, with rolls of JustTint that can be applied to existing glass designs. JustTint is a flexible film that works on curved surfaces, freeing designers to think beyond flat, square sunroofs or other glass configurations. In addition, JustTint only requires power when the tint level is changed. When the tint level is at a constant state of 50 percent, for example, zero power is drawn from a car battery. The amount of power required is so low, a smart glass system could easily be designed to run off a small solar PV panel or battery, making JustTint energy independent.

E Ink is currently partnering with auto glass manufacturers to collaborate on product development with the goal of scaling up for a mass market. As more auto companies become aware of JustTint’s unique properties, it’s likely that new applications will come about beyond the sunroof.

## Smart building retrofits: the next wave for smart glass.

Smart glass is an attractive choice for architects seeking a combination of improved aesthetics and energy efficiency, an alternative to clunky mechanical blinds or shades. The use of double-pane electrochromic Insulated Glass Units (IGUs) can reportedly save up to 20 percent more energy than double-pane, low-E IGUs across a range of climate zones.<sup>3</sup> This level of energy savings can really add up when you consider that approximately 39 percent of all energy consumption in the United States is from buildings (higher in urban areas).<sup>4</sup>



Smart glass provides architects with the ability to make buildings energy efficient.

Several factors, however, are limiting the adoption of energy-saving smart glass. The first is cost. Electrochromic smart glass might cost three times as much as standard low-E IGU.<sup>5</sup> Building managers may be hesitant to invest in any technology that requires a significant payback period.

Another gating factor to smart glass adoption is the reality that most buildings are old, and retrofitting with electrochromic glass may not be feasible (there are 5.6 million commercial buildings and 118 million housing units in the United States, with an average age of 41.7 years.<sup>6</sup>)

***“The fear of a costly upgrade that may not deliver the intended results in a timely fashion often stalls progress on retrofit projects.”***

***— Remo DiFronzo, director, smart buildings, ThoughtWire***

Electrochromic glass requires continuous power to operate, which means every pane must be wired, creating added retrofit costs beyond the cost of the glass alone.

JustTint is being engineered to solve these challenges, opening up the market for smart glass building retrofits. As mentioned in the auto glass section of this paper, JustTint only draws power when the tint level is changed, versus the constant (albeit small) power drain that's standard with electrochromic glass systems. JustTint windows would require so little power they could run off small batteries or solar photovoltaic (PV) cells. In addition, JustTint can be applied to existing glass within older buildings. The upshot is that JustTint can bring many of the benefits of smart glass to older buildings without costly rewiring, or having to install entirely new windows. JustTint also delivers color consistency, with attractive shades of gray, an important consideration for architects seeking uniformity.

There are trade-offs for architects and building managers to take into account. One is opacity or "haze." In its 100 percent open state, JustTint has a haze value of 7.5 percent. By comparison, electrochromic smart glass typically has a haze value closer to 2 percent. Decision makers will need to balance the ease of installation and lower cost of JustTint with the desire for maximum clarity. In the meantime, E Ink continues to refine JustTint to reduce the haze level. Through ongoing collaboration with OEMs E Ink will listen to the market and find the ideal relationship between functionality, cost and benefits.

### **Other applications to come.**

Leading global companies are already exploring ways to incorporate JustTint into their automotive or architectural products, while new innovations in other sectors are on the horizon. After all, smart people will always come up with unexpected ways to disrupt markets. It's entirely possible, for example, that JustTint could be built into swimming pool linings to control water temperature. Or used in solar panels to reduce the excessive heat that can diminish photovoltaic efficiency. This white paper is an open invitation to product developers in all industries to be creative. Through the establishment of strategic partnerships, E Ink will jointly bring this promising technology to market.

---

## About the Author

Ted Page is a Co-Founder and Principal of Captains of Industry. Page has created content and marketing for a wide range of global companies including Apple, Microsoft and Starbucks.

---

## About the Sponsor

E Ink is the originator, pioneer and commercial leader in digital paper technology. The company delivers its advanced display products to the world's most influential brands and manufacturers, enabling them to install extremely durable, low-power displays in previously impossible or unimaginable applications and environments.

E Ink encompasses the combined E Ink Corporation, which was spun out of the MIT Media Lab in 1997 to commercialize electronic ink and EPD technology, and Prime View International, which was established in 1992 as the first TFT LCD company in Taiwan, focusing on high-quality small-to-medium sized TFT LCDs. In 2009, Prime View acquired E Ink Corporation to further integrate and expand the EPD supply chain and the new combined companies were branded as E Ink.

E Ink's corporate philosophy centers around delivering revolutionary products, excellent user experiences, and environmental benefits through advanced technology development.

## Sources:

1. AAA
2. TheDrive
3. How to Specify Smart Glass, Architect Magazine
- 4: U.S. Energy Information Administration (EIA)
5. How to Specify Smart Glass, Architect Magazine
6. National Institute of Building Sciences