Five common misconceptions about SMART GLASS

Considering using SMART GLASS in construction, retail, transportation or consumer devices? Doubtless you'll have read about this dynamic glazing technology. However, having heard many misconceptions in our experience of manufacturing smart glass display cases, here are some clarifications on the most important ones.

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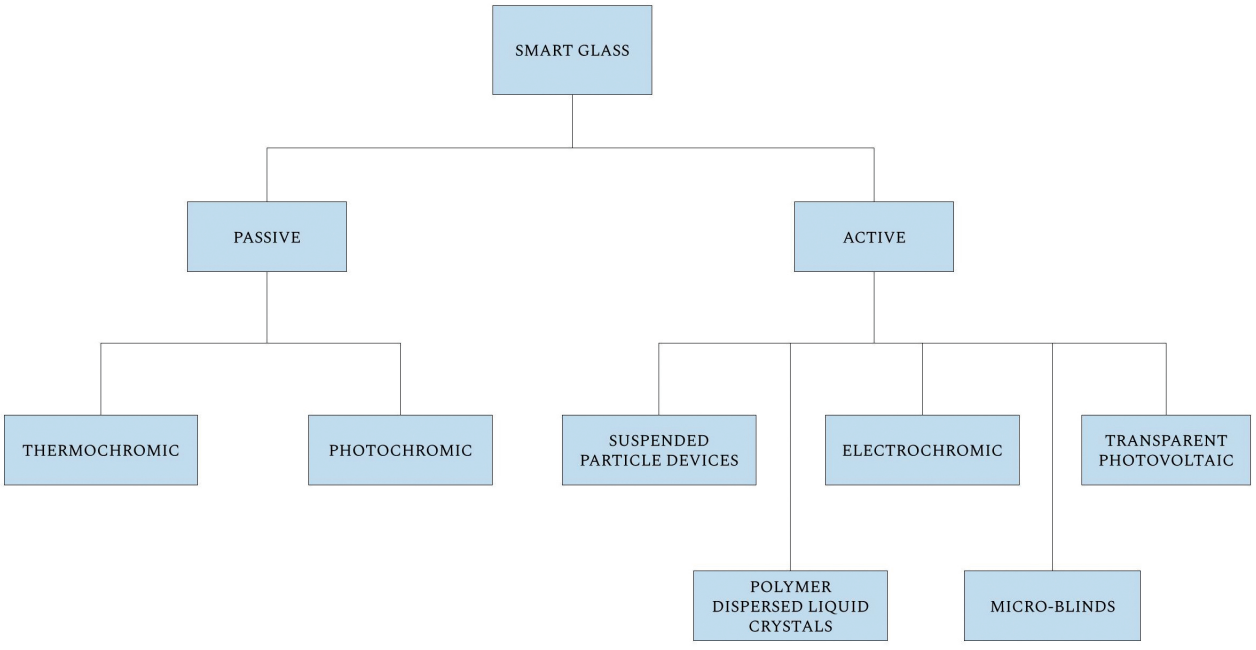
MISCONCEPTION 1: SMART GLASS IS A PRODUCT

Smart glass is not one single product but rather a family of technologies. We can think of this family as segmented into two major groups, namely 'passive' and 'active'. Passive smart glass reacts to an environmental stimulus such as light or temperature, with examples such as thermochromic glass (triggered by heat) and photochromic glass (triggered by shorter-wavelength UV light). Active smart glass, on the other hand, is driven electrically, and can be triggered by sensors or by a building management system (BMS), with examples that include SPD (suspended particle devices), PDLC (polymer-dispersed liquid crystals), electrochromic glass, micro-blinds glass, and even TPV (transparent photovoltaic) glass. You could even go as far as to include smart mirrors, augmented-reality spectacles (think Google Glass or Apple Glass) and heads-up displays (HUDs) found in aviation and high-end automobiles.
The diagram below shows a loose taxonomy, though it doesn't pretend to be complete.

MISCONCEPTION 2: SMART GLASS IS JUST FOR BUILDINGS

We can find smart glass in automotive, aviation and marine vessels as well as consumer displays, healthcare, luxury retail - even in museum display cases (example shown below, where the smart glass reduces light exposure damage on fragile artworks).
Among the coolest examples of smart glass we've seen is the BMW i Vision Circular concept car, launched in 2021, which integrates smart glass into the front kidney grilles, to recreate the classic BMW design front entirely as a digital icon, rather than with physical metal. Yet another example is the transparent OLED (organic light-emitting diode) display panel by the South Korean giant LG, which uses Gauzy's SPD technology in replacement windows for public transportation. The display panel enables high contrast ratios, making the OLED adaptable to bright environments and shifting light conditions. The sheer variety of smart glass technologies opens up numerous other opportunities to control light 'on-demand', such as neonatal incubators, wine coolers and drone-based transport of human organs - where light needs to be controlled on sensitive materials.



MISCONCEPTION 3: SMART GLASS IS JUST PLEXIGLASS

Introduced in 1933 by Rohm & Haas as the trademark Plexiglass, this acrylic, more correctly named poly(methyl methacrylate), or PMMA, is a transparent thermoplastic normally manufactured in sheets. It is static in behaviour and consists of one single material. Smart glass materials, on the other hand, are complex composites, made up of multiple layers of plastic, conductive material, coatings and/or switchable film, which is what provides the dynamic light-filtering capability. The exact composition depends upon which smart glass family member you are referring to, of course.

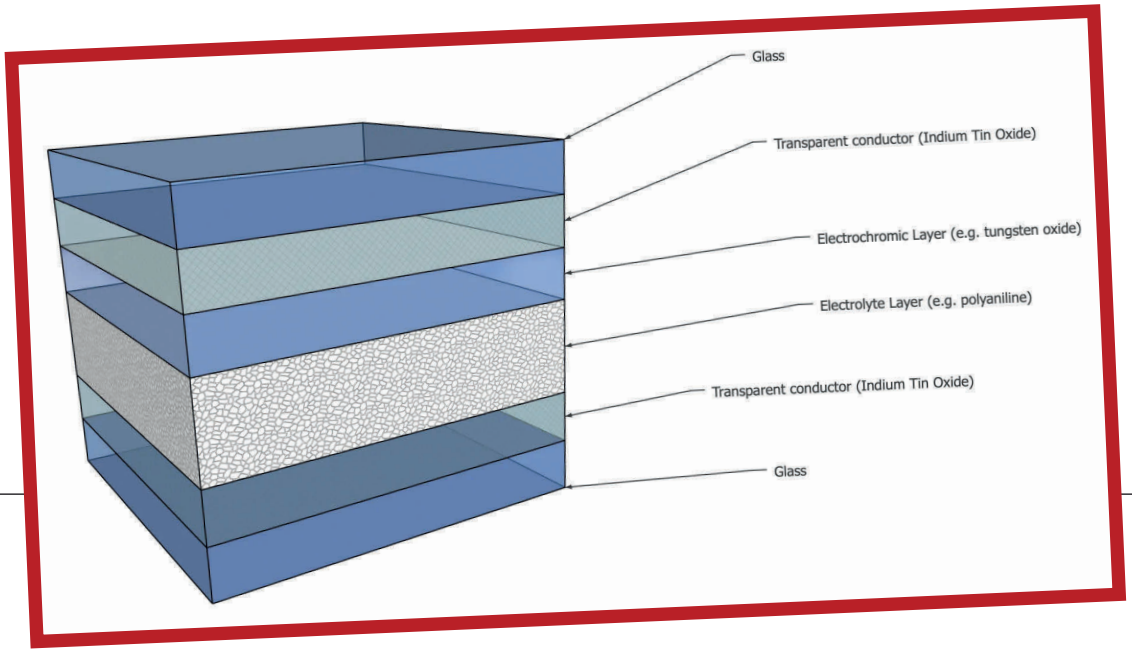
As one example, suspended particle devices technology (SPD-SmartGlass® from Research Frontiers Inc) uses indium tin oxide (ITO) as the transparent conductive layer, and is sandwiched between PET, EVA and/or PVB transparent laminating layers.

Electrochromic smart glass, however, is quite different in structure - comprising layers of materials such as tungsten oxide, polyaniline, ITO and a glass substrate. Electrochromic smart glass resembles a battery with ions being transported between electrolyte and electrochromic layers. The diagram below shows one possible configuration. Do note, however, that each manufacturer will have their own stack design.

MISCONCEPTION 4: SMART GLASS CAN ONLY BE SWITCHED ON OR OFF MANUALLY

Several smart glass technologies can be dimmed to any level between completely opaque or translucent or transparent by dimmer modules that also allow control and digital connectivity.

Assuming we're talking



about active smart glass, the driving signal can be an analogue DC voltage or current or an AC voltage, or alternatively digital commands from building automation technologies such as Konnex.
The possible activation triggers are diverse:

- By sensor (e.g. temperature, light or proximity) integrated into buildings, vehicles or consumer devices;
- By building-automation systems (e.g. Konnex), configured by occupants or automatically;
- By web-based data feeds (e.g. monitoring social media chatter to predict terrorist threats, and making smart glass building facades transparent to enable visibility and aid evacuation);
- By voice control systems (think Alexa, Google Home or Apple's Siri).

The ways to drive smart glass and the resulting benefits are extremely varied and depend on materials, technologies and application area.

MISCONCEPTION 5: SMART GLASS IS PROHIBITIVELY EXPENSIVE

The industry needs to think of smart glass just as we think of solar panels - a capital investment, with subsequent operational benefits and cost savings - leading to a quantifiable payback period.
The typical payback period for the solar panel industry is six to ten years. This is the time that it takes for the investment to 'pay itself off'.
Thus, when talking about smart glass we must look at the Total Cost of Ownership (TCO) rather than just the cost of build or installation. The TCO figure also includes the operational costs (and cost savings) which occur as a direct result in this investment.
Here quantifiable benefits of smart glass systems include:

- Reduced air-conditioning costs in the building or vehicle - thanks to filtering of infrared solar radiation (i.e. heat);
- Reduced colour-fading and deterioration of fashion textiles, artworks and other light-sensitive materials - with the consequent protection of their market value;
- Increased productivity, comfort and retention of employees and customers, thanks to user-configurable levels of glare;
- Switchable privacy screens to protect sensitive data in banks, healthcare facilities and retail point-of-sale areas - with cost savings due to reduced security breaches, improved customer satisfaction and reduced reputation costs.

These are sometimes difficult to quantify, but it should be made known that there is indeed a number, though we may not know it at the start of the project.

CONCLUSIONS

There are many misconceptions about smart glass technologies - which is understandable, since their adoption is still relatively low.
That said, the technologies aren't necessarily new, and they've been applied successfully in many vertical sectors - from construction to transportation to healthcare.
We do still receive questions from clients who've unknowingly developed an incomplete understanding of what smart glass is, so I hope this article goes some way to turning that ship around.
When one considers the urgent push to environmental sustainability and reduced carbon emissions, one might argue that our world literally depends upon the rapid adoption of smart glass technologies in order to accelerate this development.

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