



## Making light

**13/08/2018** Nothing improves efficiency more than cutting weight. But the road to lightweight design is a stony one. Time then, perhaps, to change course and venture forth upon paths untrodden. By checking our smartphones, no less, as evidenced by the new Porsche 911 GT3 RS.

Besides new manufacturing methods, innovative materials play an increasingly important part in automobile construction. In the interplay between high-strength steel, deep-drawn sheet steel, light alloys and plastics, we seek resistance to temperature fluctuation, enduring toughness, the capacity to absorb loads in a crash and material purity for recycling after replacements. The materials are further expected to throw their (light) weight into improving the efficiency of the overall vehicle.

Researching improvements for existing materials is no longer sufficient if these requirements are to be met. We need to think outside of the box and see what's going on in other fields. At Porsche, glass technology has been receiving a lot of attention in recent years. The desire to make heavy glazing lighter is by no means new. Motor racing has in the past substituted it with plastic, for instance with Makrolon®. However, the material's low resistance to scratching and its less-than-optimal visual characteristics prohibit it from use in mass-produced road cars. This is why the engineers have been looking into the matter of thin-film glass. The material, which became known as Corning® Gorilla® Glass,

is a thin glass that has been used as a cover material on mobile consumer electronics. Tablet PCs, flat-screen TVs, and smartphones have been using it for years. Its benefits: ideal visual characteristics, low weight, very high strength. Porsche first used glazing of comparable quality for the laminated glass in the rear window of the Porsche 918 Spyder with Weissach package. The roughly 20-by-20-centimeter flat pane would have to be considered trying-on-for-size. We're thinking bigger today.

Drawbacks? There are some, but not many. Presently, production is still expensive, not least because the automotive industry is only a minor customer for those manufacturers dealing in this quality of glass. Primary demand arises from displays for consumer electronics. There's also as yet no solution to the glazing's greater flexibility preventing it from use as a lowerable door window: At higher speeds, the air stream would bend the glass outward and impede closing. For the mid-term, the plan is to use a hybrid composition using the chemically compressed thin glass only for the interior side of a compound glass pane.

## Classic material, new approach

The technology for processing thin-film glass has progressed enormously over the past three years. Engineers are now capable of realizing curved panes of thin-film glass, the first specimens of which saw the light of day in a Samsung smartphone. What we know as Gorilla Glass from smartphones is actually little more than an age-old material: glass, the same stuff made of recycled glass shards, sand, and—when it comes to car windows—a thin safety film between two layers of thin glass.

For glass to become thin-film glass, it first needs to undergo chemical treatment. To human perception, glass appears smooth and flat, but seen through an electron microscope, it is as jagged and fissured as a canyon. The floors of the crevasses are littered with molecules. A chemical treatment draws them out and replaces them with larger molecules that cram into the gap and thus increase material density at surface level. This increases the glass's compressive stress and makes it extremely strong. Tests have shown that a thin-film glass windshield with a 2.1-millimeter exterior layer and a 0.55-millimeter interior layer combined with PVB safety film is at least 200 percent stronger than a conventional compound glass windshield. Such a windshield would be substantially more resistant to hail and stone chipping, be far more impervious to scratching, and break only at much higher loads in a crash. Add to this the fact that thin-film glass possesses a degree of flexibility and is thus capable of enduring more body torsion.

## Lighter, yes. And quieter, too.

The weight saved is enormous. The conventional single-layer safety glass version of the current Porsche 911's rear window, for example, weighs 5.8 kilograms. The same window made of thin-film glass weighs only 3.7 kilograms, cutting the weight by about forty percent. And that's only one

component. At present, Porsche uses this glazing on the Porsche 911 GT3 RS, whose rear window and rear side windows are made of it. But it gets even better. The new compound glass offers greater UV protection. In this case, however, we have the safety film to thank for blocking 99 percent of the UV radiation. Conventional single-layer safety glass without the film blocks only around seventy percent. The high optical quality of thin-film glass considerably reduces the perceptible distortion familiar from thicker glazing, especially at the low slope of the installation angle. On top of that, the glass also thaws out much quicker in frosty weather, simply because it is thinner. With a view to electric mobility, we find yet another benefit in the greater damping effect on high-frequency sound waves.

## More glass in the passenger compartment?

Right now, Porsche is investigating improved infrared reflection. Current levels match that of familiar glazing types, but the aim is to enhance functionality to achieve higher heat insulation. Thin-film glass could also revolutionize surface design in the passenger compartment. Radically new controls in the form of curved, touch-panel displays could offer drivers a means of completely customizing all controls to suit their personal preferences. One vision doing the rounds: Drivers save their custom passenger compartment configurations on My Porsche and thus get their own, entirely personalized control interface in any Porsche they drive. Over time, thin-film glass of various properties will replace glazing in more and more walks of life. The benefits are evident. Besides greater strength at lower weight, the much higher sound insulation will make thin-film glass the go-to choice for electric mobility in the automotive industry.

### Link Collection

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