



# Materials are key to future vehicles' interiors

*Durability, personalization, and seamless connectivity are vital to tomorrow's cars*

By Robert Grace

Consumer technology, environmental consciousness, and the future of personal mobility are converging in the interiors of tomorrow's vehicles. And nowhere will materials play a greater role than in the "mobile living rooms" of self-driving cars.

Automakers, designers, materials suppliers, and many more are investing huge amounts of money, time, and creative energy into seeking seamless, sustainable, user-friendly solutions. That is becoming more evident daily, as evidenced at both last October's K 2019 plastics show and January's huge CES 2020 consumer technology show, where car design and electronics are increasingly converging.

Recent noteworthy rollouts include:

- » BMW's i3 Urban Suite concept car;
- » Covestro's future of mobility interiors concept; and
- » Polestar's electric concept sedan, the Precept.

Consulting giant McKinsey & Co., in a 2018 report recounting recent consumer survey results, stated: "While both exterior and interior styling will be differentiating factors for premium OEMs, interior customization will become more prominent." The report also noted that "connectivity and design are becoming critical differentiators for premium customers in choosing premium vehicles."

In McKinsey's poll of more than 2,000 consumers, some 70 percent indicated that the ability to customize the

interior of a car to meet their needs will become a major decision point within the next five years.

The number of display surfaces and touchscreens in interiors will increase dramatically due to the trends of digitalization, connectivity, and autonomous driving. This will open new opportunities for products such as polycarbonate films to play an important role in the manufacture of large, jointless, decorative surfaces with a high level of perceived value and in the integration of large displays.

## BMW's Ride-Sharing Luxe

At CES in Las Vegas, BMW showcased its BMW i3 Urban Suite concept car, designed like a luxury hotel pod on wheels. The German automaker invited show attendees to take a test ride in the vehicle (20 of which BMW converted in Munich and shipped to the Nevada show).

The i3 Urban Suite still includes a driver's seat (recognizing that full, Level 5 autonomy is still years away), but the rest of the vehicle is devoted to a single, ride-sharing passenger -- complete with a comfortable, teal-fabric lounge chair and an electrically adjustable footrest, with a wood-surfaced table and lamp beside the chair in the back seat. A TV screen flips down from the headliner, and a focused sound system allows for acoustic privacy.

Features include a clothes hanger for jackets and coats, a storage tray between the driver's seat and wooden



BMW designed its i3 Urban Suite concept car as a sort of luxury hotel pod on wheels for a single ride-sharing customer. Courtesy of BMW

table that is large enough for a bag or laptop, and a pair of thermoelectric cup holders in the center console that can warm drinks up or cool them down.

Citing its commitment to sustainable mobility, BMW states: “Fabrics containing recycled materials therefore come together with certified wood and olive-tanned leather, while the floor mats are made from recyclable materials that can be fed back into the materials cycle, as per circular economy principles.”

Once inside the vehicle, the passenger can connect his or her iPhone to the car wirelessly and mirror the mobile device’s content to the flip-down overhead screen and then work on the screen. The cabin also includes 110-volt charging sockets to power the passenger’s devices. (This 8-minute video shows more: [http://bit.ly/BMW\\_i3\\_concept](http://bit.ly/BMW_i3_concept).)

## Covestro Aims to Redefine Interiors

At last fall’s K Show in Düsseldorf, Germany, advanced-materials supplier Covestro AG unveiled one of its visions for the future of mobility. The company states that autonomous vehicles, electric cars, and car sharing “will soon fully redefine the use of a vehicle,” with the car becoming a multifunctional, mobile living and working space. “This is the guiding principle of a premium interior concept for future mobility.”

Future cars will be fully networked and seamlessly integrated into everyday life, according to Vice President Jo-

chen Hardt, of Covestro’s Global Marketing Mobility team, who served as project manager. “Modern materials and technologies have paved the way for this.”

Hardt noted that Covestro’s concept includes developments that may become reality in a few years, but that also includes visionary ideas for the future. “We are particularly focused on the interior design ... Future vehicle concepts for electromobility offer car manufacturers opportunities for completely new room concepts and additionally open up a new ground for brand differentiation.”

Covestro worked on this project with various partners, including a pair of Finnish firms—TactoTek Oy, which develops, commercializes, and licenses in-mold structural electronics (IMSE) technology for smart surface solutions, and Northern Works, a small industrial design studio based in Turku, in southwestern Finland.

Miika Heikkinen, industrial designer and founding



Finnish designer Miika Heikkinen worked with Covestro for two years on its future interiors concept. Courtesy of Northern Works



Covestro unveiled the future interiors concept at the K Show, highlighting how interior space might be used efficiently in autonomous vehicles. Courtesy of Covestro

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partner of the Northern Works studio, worked with Covestro for two years to design the vehicle. The first step, he explained in a Feb. 27 phone interview from his home in Turku, was to try to identify key megatrends likely to impact future car-design trends.

Their research indicated that the ability to work remotely, via a mobile office, was highly desirable. They also determined that a big problem with car sharing is that the interior is not personalized and doesn't reflect the preferences of the user. "The stigma with car sharing," he said, "is that you end up doing generic vehicles that don't appeal to anyone."

So Heikkinen and the Covestro team worked to tackle those issues with their latest interiors concept. Material choice plays a key role, especially with sustainability such a factor now.

"We need a more holistic design, and we need to justify the use of each material." Low weight, durability, and resilience all come into play. Natural materials also can be highly suitable, such as the very thin sheets of marble used on the floor of this vehicle.

Beneath the marble veneer, Covestro says "the floor is completely reimaged with polyurethane materials,



The multifunctional concept car's interior focused on blending durable materials with customizable lighting and features. Courtesy of Covestro

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creating a welcoming, pleasant, home-like ambiance." They used their Baypreg two-component polyurethane system, combined with glass-fiber mats and core materials such as paper honeycomb or expanded polycarbonate, to significantly reduce weight (versus

the typical steel) while maintaining high mechanical strength.

Covestro noted how the concept focuses equally on functionality, comfort, and design, but also on efficiency and light weight. The focus is on multi-sensor infotainment systems, innovative seating concepts, smart surfaces, and personalized lighting.

The large, three-dimensional, multifunctional display made using Makrolon Ai polycarbonate and Makrofol PC film. Covestro combined in-mold decoration and film insert molding to provide the surface design and durability.

## In-Mold Structural Electronics

On the concept car, TactoTek provided an overhead console that incorporates integrated electronics using the Finnish firm's IMSE technology, which is an advanced form of film insert molding.

"We've done considerable work with Covestro as we've industrialized IMSE technology and identified the materials stacks and processing required for high-yield manufacturing, high-quality cosmetics, and lifetime reliability," said Dave Rice, TactoTek's senior vice president for marketing and business development. "That learning, and the validated materials combinations are then used in customer projects, most of which are in

automotive today."

IMSE can greatly reduce the number of components in a given stack, thereby simplifying production and reducing cost. Polycarbonate films serve as an effective moldable carrier for printed electronics, enabling the integration of additional functions, Covestro notes.

The interiors concept also includes functional surfaces with a premium look and feel. The partners found a way to use materials such as wood, stone, and aluminum for various interior trim components, some of which they combined with injection molded transparent or translucent Makrolon Ai polycarbonate "to create ambience." That particular resin can be used in combination with light outcoupling technologies such as injection molded or laser-engraved microstructures to produce new types of lighting effects.

## Rigid, Lightweight TP Composites

Additionally, the Leverkusen, Germany-based company says it leveraged the tunable properties of its Maezio-brand, polycarbonate-based, continuous carbon-fiber-reinforced thermoplastic composites to create robust, very thin and extremely lightweight seat shells.

Padded with polyurethane (PUR) foam layers and then covered with fabric made using the firm's water-based INSQIN technology for textile coating, the resulting



The back seat features a movable privacy dome with sound-absorbing acoustic materials to provide an oasis of peace and quiet. Courtesy of Covestro



seats are said to offer the same attractive appearance as leather, but at lower cost and with reduced solvent emissions. Light also can be allowed to shine through the coated surface, creating a new type of ambient lighting. The INSQIN technology featured as well on the textile coatings for the headrest and dashboard.

Covestro and its partners also developed a flexible, lightweight table tailored to new usage habits in autonomous vehicles. The thin-walled prototype—just 4 to 6mm thick—was also made of Maezio composite material and can be designed to be foldable so that it can be stowed between the rear seats to save space.

Heikkinen seems particularly proud of a couple innovative features. One is a so-called “privacy dome” that can lower over a passenger’s head, offering a mini oasis of peace and quiet. The movable dome uses sound-absorbing acoustic foam based on Covestro’s Baynat PUR system, allowing the user to take a phone call in privacy, or to simply relax to soothing sounds, such as that of waves on a beach.

Additionally, he pointed out, the car’s electrochromatic side windows can transform from clear to opaque and serve as a Skype screen, for example. It delivers “a hologram kind of feeling,” he said. (See a brief YouTube interview with Heikkinen sitting in the car at K: [http://bit.ly/Miika\\_K\\_interview](http://bit.ly/Miika_K_interview).)

## Polestar Precept Goes Green

Polestar, the electric performance car brand jointly owned by Sweden’s Volvo Car Group and China’s Zhejiang Geely Holding, launched in 2017 with the Polestar 1, a low-volume, hybrid-electric GT. Last year it introduced the Polestar 2 as the company’s first all-electric, high-volume premium car.

The company is planning to roll out Polestar 3 as a fully electric, high-performance SUV. But in late February, it showcased the Polestar Precept electric concept sedan that focuses on its use of sustainable materials and a deeper integration with Google’s new Android Automotive operating system—with a view to communicating “what Polestar stands for.”

Polestar CEO Thomas Ingenlath says that, beyond simply the powertrain, “It’s clear that to be truly sustainable we have to evaluate every element that goes into our cars,” with an emphasis on using recycled materials. Ingenlath assumed this post in mid-2017, after serving as senior vice president of design for Volvo.

Polestar cites the following material choices in the Precept:

- » 3D-knit woven fabric, made from 100 percent recycled PET bottles, for the seating surfaces. “It looks and feels premium,” says Ingenlath, yet “reduces waste, and the production process itself wastes nothing as the material can be made to size,” with no cut-offs.
- » Recycled nylon 6, fashioned from discarded fishing nets obtained from an international collection network, is used in woven carpets.



The Precept’s 3D-knit woven seat fabric is made entirely from recycled PET bottles. (left) Flax-based structural ribs supplied by Switzerland’s Bcomp Ltd. provide lightweight, rigid, bio-based reinforcement to the seat backs and other interior panels. (right) Courtesy of Polestar

- » Cork, with waste products from the cork manufacturing process and even entire bottle stoppers, is used to form part of the interior PVC components.
- » Woven flax fibers from Fribourg, Switzerland-based Bcomp Ltd., whose lightweight powerRibs material forms a reinforcing grid used in the seat backs and some interior panels. Using Bcomp's biomaterials is said to reduce the weight by half and the plastic content by 80 percent, compared with conventional materials.

None of these materials come at the expense of design or quality, Polestar claims. "If anything," says Maximilian Missoni, the firm's head of design, "they enable even more premium, cutting-edge, modern, and stylish executions which elevate our design-led products. We were able to derive new aesthetics from new contexts and technologies."

Plastic has been reinvented multiple times, Polestar declares in a news release—from miracle material, to scourge of the environment, to a new, sustainable definition of premium. Plastic has found its third act, one that ensures its incredible shelf life is leveraged.

"At Polestar," notes Missoni, "we see technology as an

enabler, as a tool to solve our society's problems and we translated this attitude into a new set of design principles. The combination of sustainable materials and high-tech smart systems opens an entirely new chapter of avant-garde luxury design and shows where Polestar is heading." (See this "Evolution of the EV" video with Polestar's Thomas Ingenlath for more insights: [http://bit.ly/Polestar\\_Precept](http://bit.ly/Polestar_Precept).)

#### ABOUT THE AUTHOR

Robert Grace is a writer, editor and marketing communications professional who has been active in B2B journalism since 1980. He was founding editor of and worked for 25 years at *Plastics News*, serving as editorial director, associate publisher and conference director. He is now both editor of SPE's *Journal of Blow Molding* and a regular contributor to various outlets. A long-time member of the Industrial Designers Society of America, he runs his own firm, RC Grace LLC, in Daytona Beach, Fla., and can be contacted at [bob@rcgrace.com](mailto:bob@rcgrace.com).



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