

Enabling the Cars of Tomorrow

November 12, 2020



November 2020



Agenda

15:00 - 15:40 Presentation: The trends reshaping car manufacturing

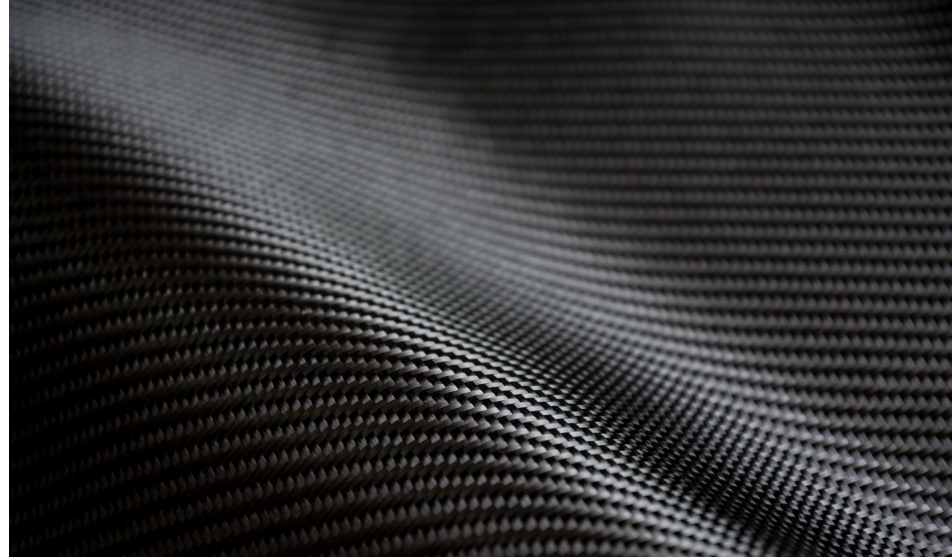
15:40 - 16:10 Panel discussion: Trend talk & QA

16:10 - 16:30 Coffee break

16:30 - 16:50 From bonnet to boot: A journey through Avery Dennison automotive solutions

16:50 - 17:30 Break out rooms:

- Fasteners: The heat is on! Securing wires with confidence, efficiency and safety
- Automotive Graphics Films: A versatile solution for personalisation and protection
- Performance Tapes: Solutions for safety and comfort
- Labels and Intelligents labelling materials: Labelling solution for every application, that's our promise.



Keynote presentation: The trends reshaping car manufacturing

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Agenda

- **Electrification:** Learn how labeling and bonding requirements are changing and how to ensure the safe performance of EV batteries and other electrical components
- **Lightweighting:** See how CO2 emissions are driving adoption of lower weight materials and how pressure sensitive adhesives enable this.
- **Autonomous Driving & Connectivity:** Learn how digital transformation is supported by performance tapes, labelling solutions, RFID and NFC
- **Cars and COVID:** How is the pandemic re-shaping the near future of the industry and its supply chain?
- **Avery Dennison R&D competencies:** Materials science and innovations on demand



Michael Sanders

Sr. Director Marketing HVS
Label and Graphic Materials
Avery Dennison

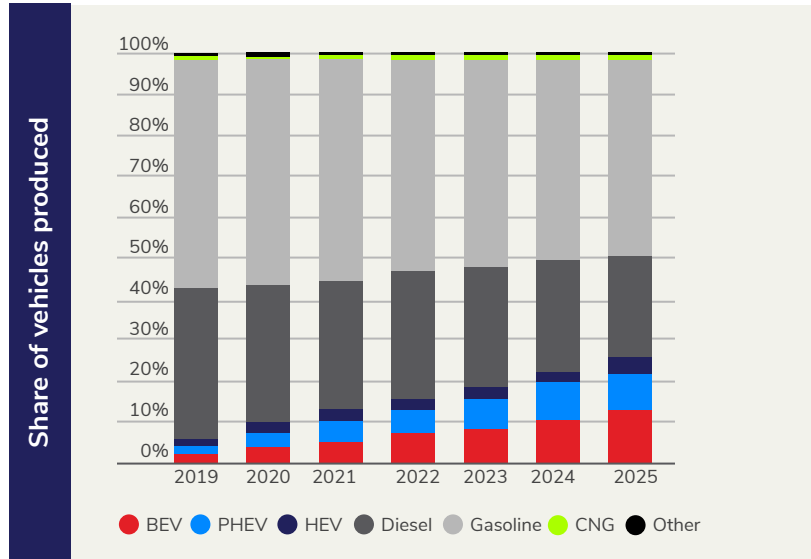
Electrification

A rapidly expanding electric vehicle market brings new labelling considerations around high voltage systems, acoustic design, and electromechanical components.

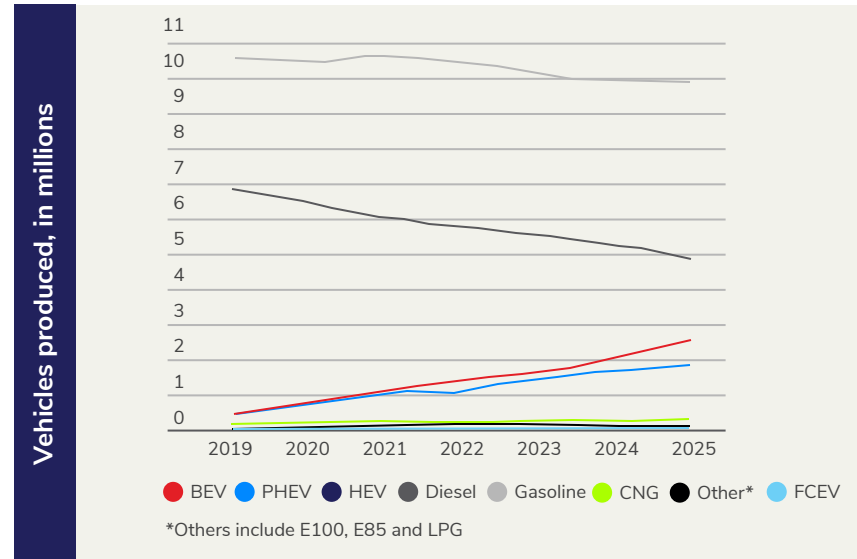


European Alternative Vehicle Propulsion (AVP) production

The number of EVs (electric vehicles) produced in Europe is expected to surge, from around three quarters of a million in 2019 to more than 4 million in 2025.



...at the expense of diesel Light Vehicles (LVs).



Electric Vehicles (EVs)

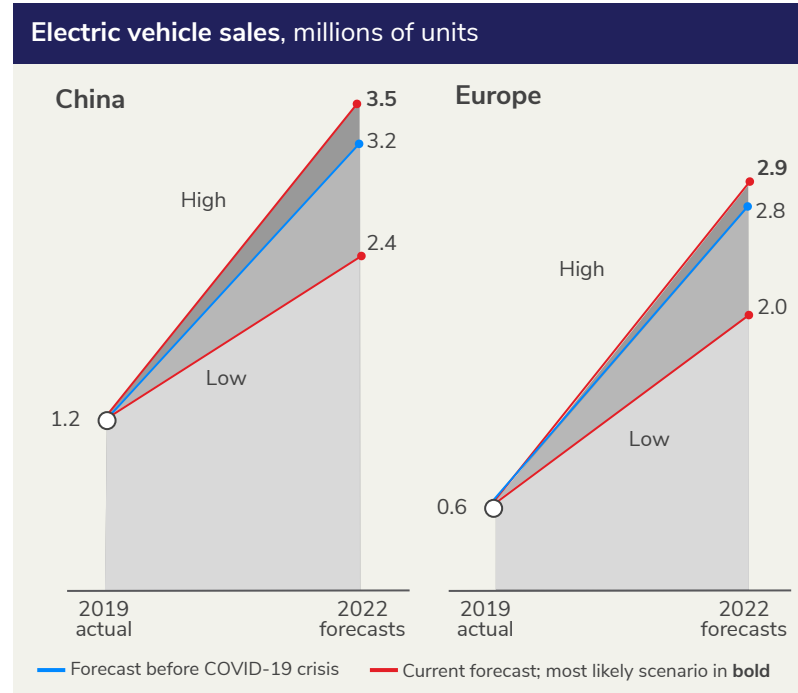
Electric Vehicles

- European EV market share is increasing, from 3% in 2019 to 7% in June 2020. By 2022 EVs may have a 12–15 % market share in Europe
- The progress in charging infrastructure is prominent
- Norway, Iceland, Sweden lead in EV penetration in Europe in Q1 2020

EV sales, Q1 2020, thousand units

	China	Germany	UK
EV Sales	133.1	52.8	33.6

source : [McKinsey & Company](#)



source: [McKinsey & Company](#)

Technology Disruption

Hot Topics: The new technologies are a disruptive force for the automotive industry and faces societal challenges

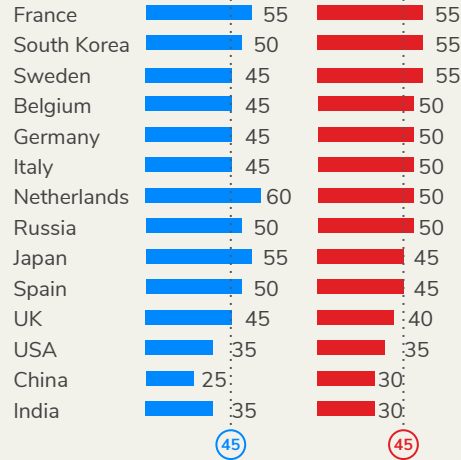
- Range anxiety: charging station infrastructure still evolving
- Fire risk of EV batteries: publicity around several dramatic car fires
- Autonomous Driving: is it safe?
- Revenues: how to move from one-off transaction to a subscription model?
- Banning of ICE vehicles from cities?

Consumer Preference - Evolution through time and region

No significant change in AV and EV acceptance - local situations remain largely stable

Autonomous

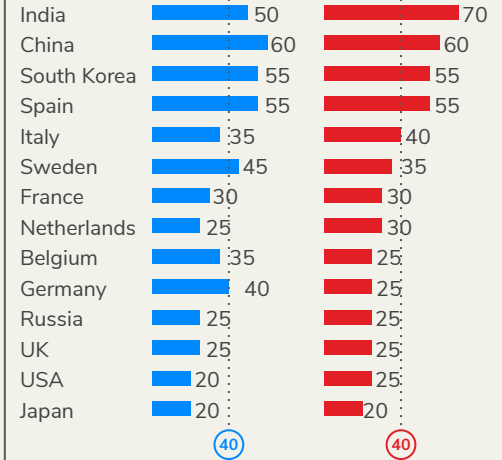
Would you still buy a car if fully autonomous robocabs could be used at lower cost per trip compared to your own car?



■ No July '17¹ ■ No Jan '20

Electrified

Are you considering buying a battery electric vehicle as your next car?



■ Yes July '17 ■ Yes Jan '20

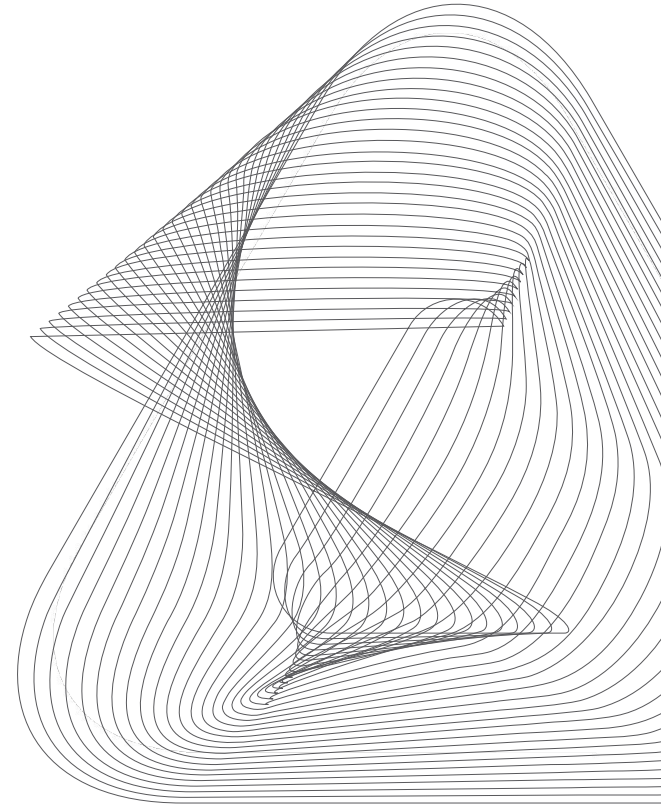
¹ Value for Italy = July 2017, values for Belgium and Sweden = Jan 2018, values for Russia = July 2008, values for Spain = Jan 2019

Source: RB online survey Jan 2020: 16,808 participants - by country: Belgium 1,1014; China 1,005; France 1,022; Germany 1,024; India 1,008; Italy 1,013; Japan 1,1014; Netherlands 1,008; Russia 1,011; South Korea 1,008; Spain 1,014; Sweden 1,025; UK 1,006; USA 1,019

source : [Roland Berger ADR#7](#)

Factors to consider

1. Change in number of elements for assembly
2. Ensuring safe performance of the EV batteries and other electrical elements
3. Increased need for acoustics design
4. The growth of advanced vehicle electrical systems is pushing the need for more sensors and electromechanical devices



EV Production: Fewer Components with More Unique Needs

EV

(Electric Vehicle)

Number of parts
+/- 10.000

Internal

Combustion car

Number of parts
+/- 30.000

High Voltage Systems: Challenges

- Ensuring safe performance of the EV batteries and other electrical elements - designing reliable fasteners, tapes and adhesive materials that can withstand high voltage, ensure isolation, sealing and venting
- High voltage electrics means increased temperatures especially during battery charging: temperature resistance in the components and modules is key need.
- Battery life nearing 100,000km / 8 years means robust solutions.



High Voltage Systems: Technical Requirements for EV Bonding



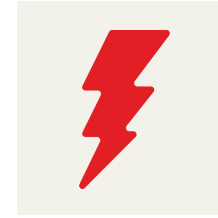
Bond Strength

- PSA deliver required levels for Cell wrapping and Cell-Cell bonding
- PSA appropriate for attachment of battery pads, thermal and insulation layers and films
- Many PSA applications act as assembly aid (Battery pads, assembly washers)



Flame Retardance

- Current specifications describe ignition behaviour of battery pack.
- Full specification list at a component or material level still evolving
- Where specified, UL94 V-0 (or VTM-0) required



Dielectric Strength

- Breakdown Voltage for components in cells, modules and packs
- Including pressure sensitive tapes and labels
- Higher dielectric strength is needed
- Theoretically 25 μ PET + 50 μ adhesive will have ~13kV

High Voltage Systems: Automotive Materials Solutions

- Single and double-coated tapes with film-based carriers enable efficient and safe bonding of cables and flexible printed circuits.
- Wire wrapping and harness fasteners protect these components from abrasion and heat to extend their lifetime
- Adhesive solutions can bond cells and pads to create the modules that contribute to isolation and protection from thermal runaway
- Bonding of venting solutions on battery packs



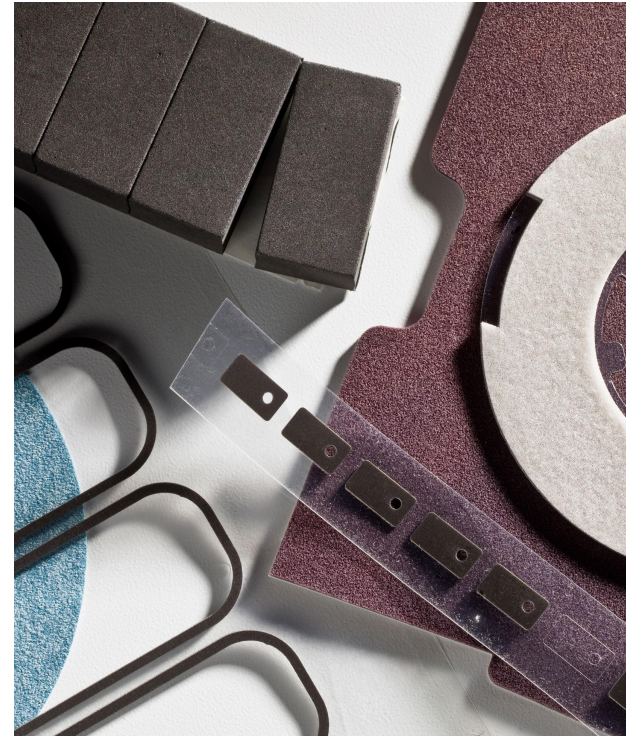
Acoustic Design: Challenges

- Removing the ICE (internal combustion engine) will also remove one of the dominant noise sources
- Other sources such as ancillary pumps, road/tyre noise and aeroacoustics will become more dominant
- New powertrain modules such as inverters will create noise that can be irritating to vehicle occupants
- Lightweight panels will allow more noise to be transmitted into the interior



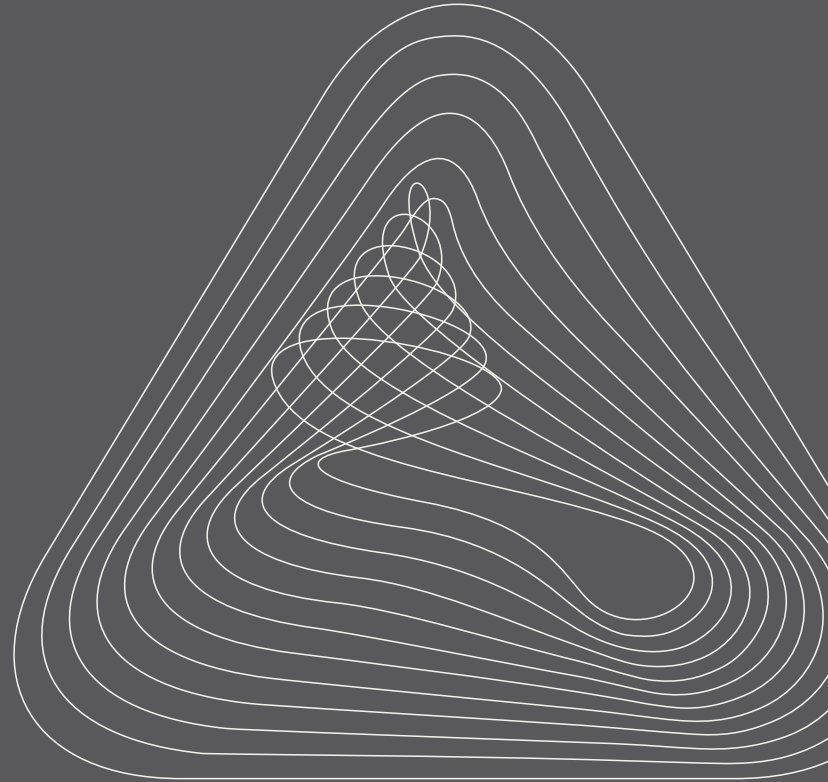
3b. Acoustic Design: Automotive Material Solutions

- Sound absorbing foams and non-wovens are effective at reducing mid-high frequency noises associated with EV drivetrains
- Pressure sensitive adhesives present a quick, reliable and lightweight solution to applying these acoustical absorbers.
- The visco-elastic adhesives can also be used to create laminate panels with enhanced transmission loss performance
- These laminated panels offer a lightweight solution for sound damping and lower noise transmission



Electrification summary

- We support the safe operation of EV batteries with solutions for bonding, insulation, sealing and venting
- Our fasteners enable reliable and secure placement of electrical components
- Our label materials and tapes hold up under high voltage with no loss of adhesion



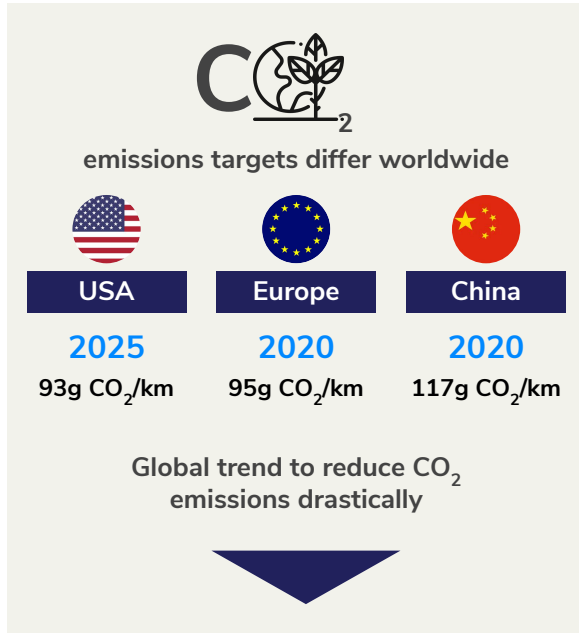
Lightweighting

Regulatory pressure is on for CO₂ emissions.

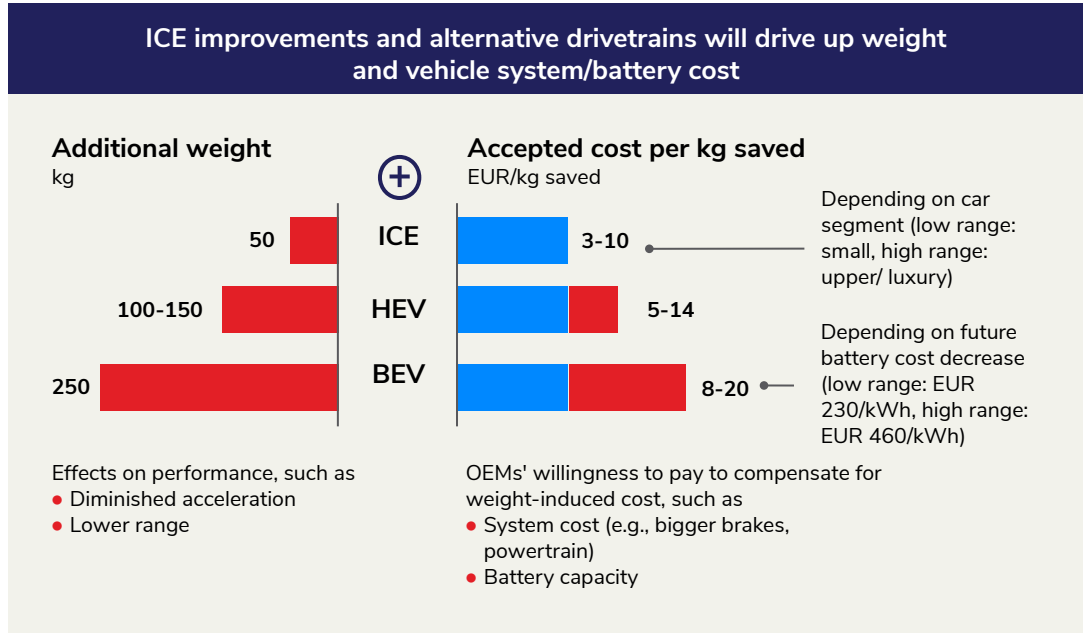
Advancements in plastics, adhesives, and films are enabling more lightweighting options that retain a premium look and feel.



Trend in Lightweighting



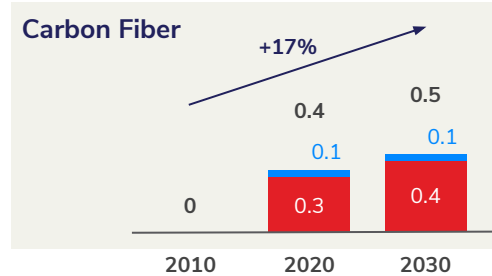
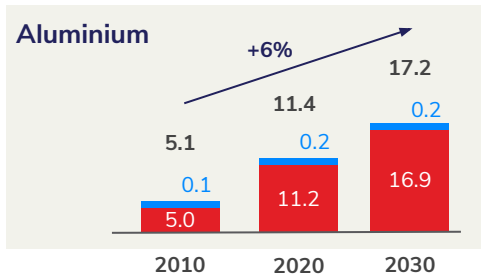
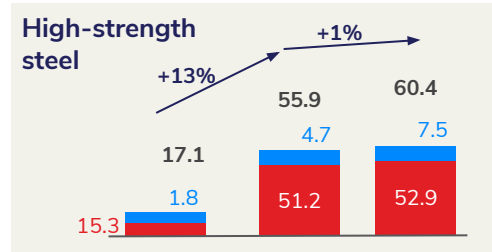
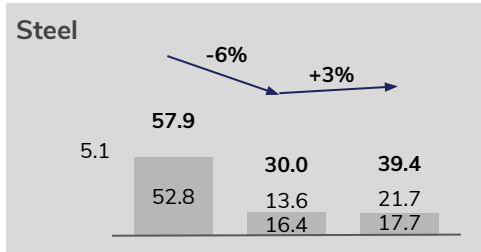
source: [ICCT Briefing](#)



source: [McKinsey & Company: Lightweight, heavy impact](#)

Trend in Lightweighting

The impact of Lightweighting on the base materials industry



Volume

Metric tons (millions)

- Aviation and wind
- Automotive

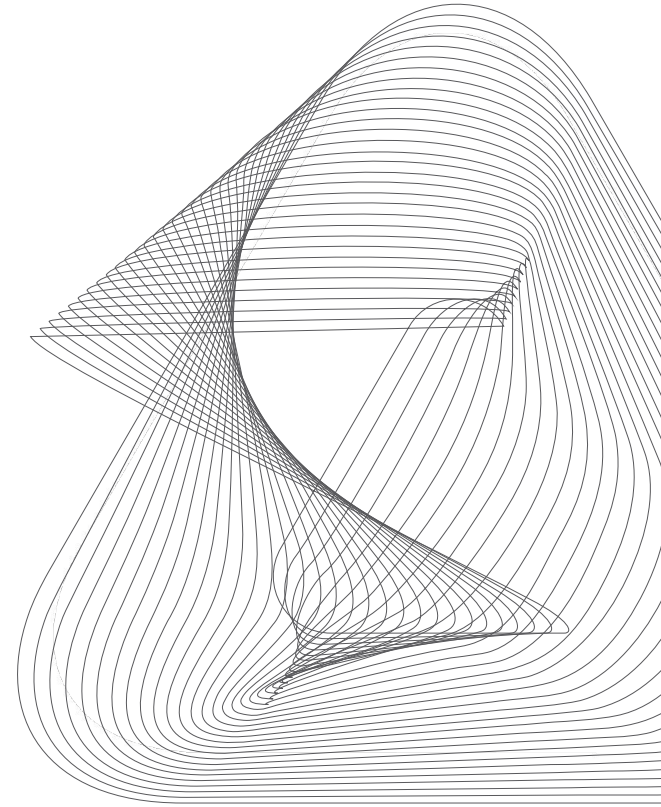
8% → CAGR

Lightweight market will increase from a EUR 70 bn to a EUR 300 bn market (CAGR 8%)

source: [McKinsey & Company](#)

Lightweighting: Factors to consider

1. Electrification is further enhancing the search for lighter materials
2. Attaching components by metal elements is no longer a preferred option due to its heavy weight
3. New opportunities for designing with lightweight materials
4. Lightweight materials often require a new approach to bonding performance



Weight Reduction through Material Mix

Increased use of plastics and other lightweight alternatives that have to be assembled to predominantly steel body structures and panels. PSA enable several lightweighting solutions:

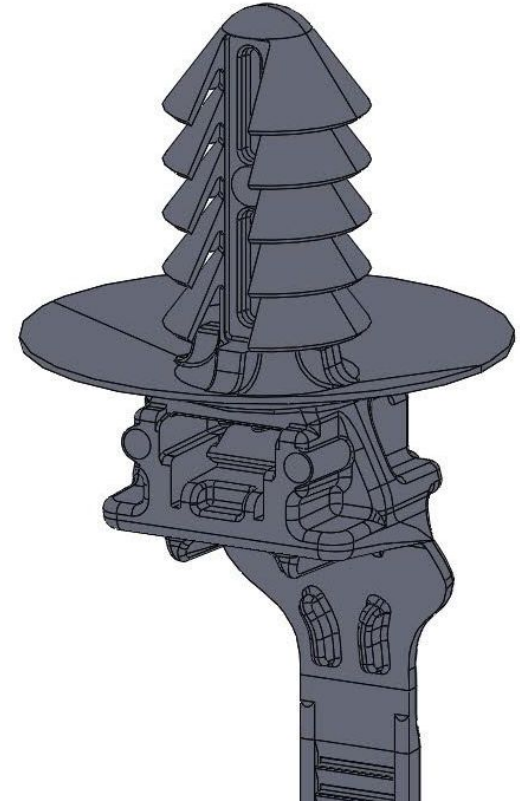
- Exterior embellishments (e.g. body side mouldings) can be bonded with acrylic foam tapes
- Weight reduction in weatherstrips and seals by replacing metal clips and channels with PSA attachment
- PSA bonding of panel stiffening parts (e.g. cardboard-based roof stiffeners) on thinner body panels can save up to 2kg and reduces risk of read-through.



Image from Plastic Omnium
(<https://www.plasticomnium.com/en/journalists-news.html>)
accessed 14/10/2020

Weight Reduction at Every Level

- Plastic fasteners weight less than metal fasteners
- Reduce weight by removing plastic without compromising mechanical performance
 - We've been able to reduce the weight of a specific cable tie by as much as 29%
 - Reduced plastic results in reduced costs. Cost reductions are passed along to the customer



Premium Look for Alternative Materials

Composite and plastic materials covered with Automotive Graphics films allow to re-create the appearance of other heavier materials (eg painted metal).

A loss in weight in addition to the possibility to have more decorative finishes.



New Lightweighting Options: Adhesive Considerations

Moving to lightweight materials means new angle of view on adhesive performance:

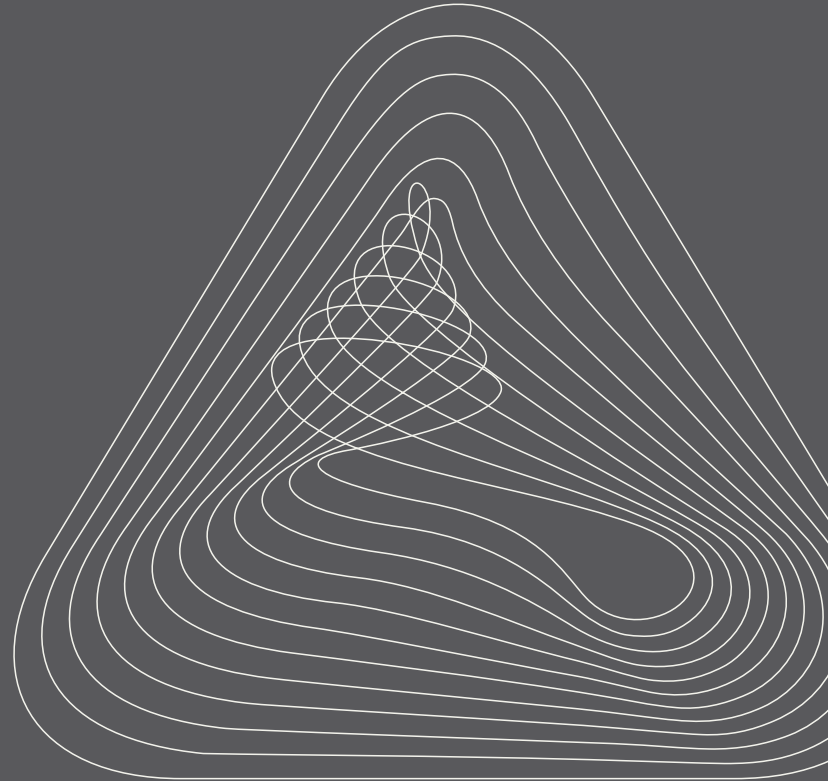
- Surface energy - in most cases getting from high surface energy to low surface energy
- Roughness - materials tend to have higher texture
- The presence of contamination - release agents used during moulding

=> Often two lightweight parts need to be attached together by a strong adhesive



Lightweighting summary

- Plastic fasteners, compared to metal fasteners, can significantly reduce weight and we use less plastic in our fasteners to decrease the weight further
- We offer alternative decorative materials that provide the same or better appearance as heavier materials
- Our tapes replace traditional mechanical fasteners for side mouldings and seals
- Our high-adhesion materials make it possible to use lightweight substrates which are often textured and contaminated



Autonomous Driving & Connectivity

The automotive sector is undergoing a transformation; driven by ambitious goals to reduce road fatalities and improve traffic flow through autonomous and connected vehicles.

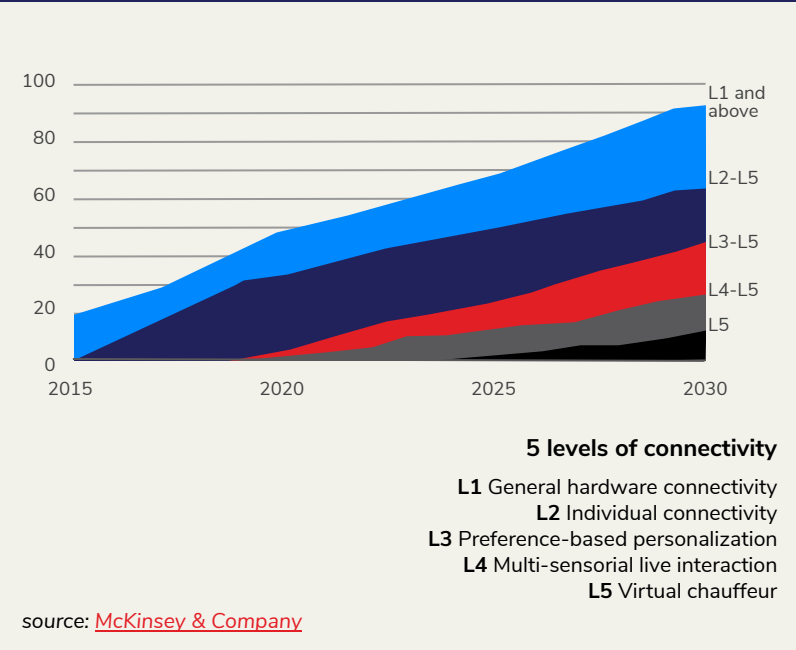
These digital transformations are being supported by performance tapes, labelling solutions, RFID and NFC.



Autonomous Driving (AD) & Connectivity

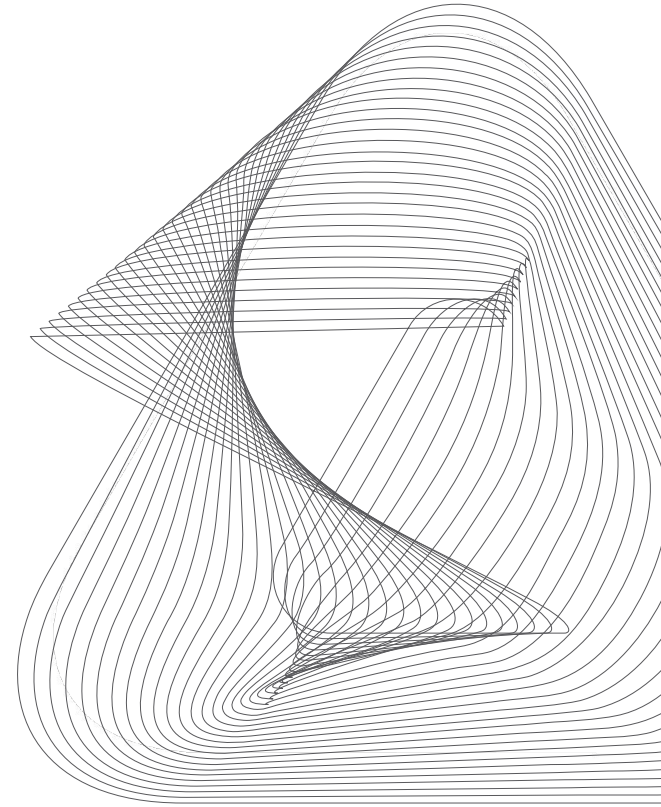
- Safety is key to AD, placing increasing reliance on passive and active systems like connectivity
- By 2030, 45% of global new-car sales could be at least level 3 in connectivity
- 40% of today's drivers would be willing to change vehicle brands for their next purchase in return for greater connectivity
- In Jan'20, GM subsidiary Cruise gave a preview of its first driverless car without steering wheel or pedals

Global penetration of connected cars, % of new light-vehicle sales by connectivity level



AD & Connectivity: Factors to consider

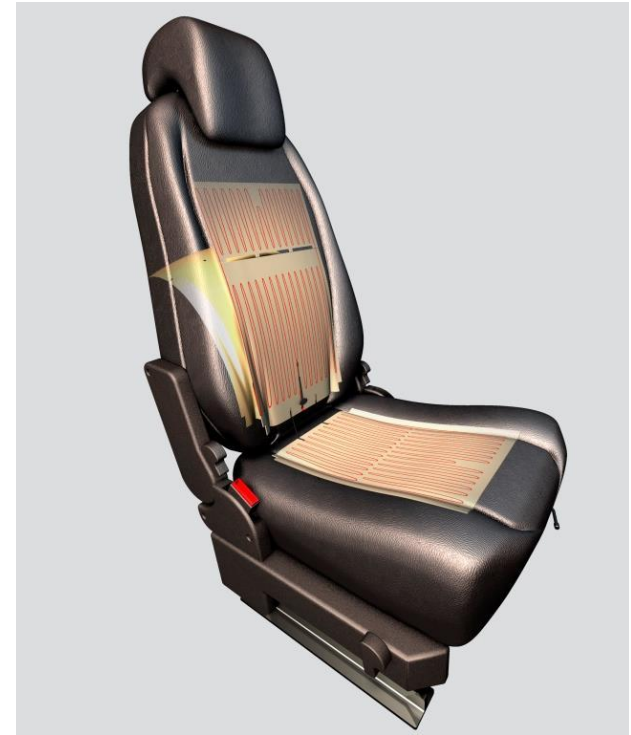
1. Increasing safety and convenience features are driving an increase in vehicle content:
 - In-Car Entertainment (screens, controls, speakers) tailored to each occupant.
 - More sensors to support passive and active driver assistance.
2. The lack of visibility in the components supply chain is a challenge for traceability
3. Confirming that each vehicle contains all the customer requested options can be complicated
4. Identifying counterfeit components in the aftermarket with NFC to defend brand reputation and product liability



Connectivity Improving Safety & Comfort

PSA solutions contribute to passive and active safety

- Sensors bonded (e.g. on seat cushions) to determine position and restrain occupant in event of imminent crash
- Sophisticated capacitive solutions for Hand-Off-Detection relies on PSA to bond the different layers together to make up the steering wheel
- Increasing Human Machine Interface (HMI) elements (e.g. touch sensitive screens and membrane switches) require bonding for assembly
- Exterior sensors bonded to bumpers and grilles to give a secure bond that also seals against dirt and moisture



Rapid increase of sensor integration: Securing Electromechanical Systems

- The expansion of advanced vehicle electrical systems — such as active safety, infotainment and autonomous driving — is pushing the need for more sensors and electromechanical devices
- To function properly and reliably, these systems need to be securely fastened and routed, often in tight spaces.
- Our fasteners deliver the performance and reliability that meet many automotive OEMs specifications



Digital Identity using RFID

Enabling greater visibility of parts & components especially safety related by giving them digital identities using RFID and NFC

- Improved material handling, automated production processes and product traceability.
- Suitable for all automotive components. Bumpers, seats, airbags, windshields, dashboards and gearboxes are often tagged
- RFID offers improved supply chain transparency from a component manufacturer all the way to an assembly line at OEM or even beyond.
- NFC tags to authenticate parts and prevent counterfeiting (especially aftermarket supply chain)



Enabling End-Users and OEMs to Create a Digital ID for every Item

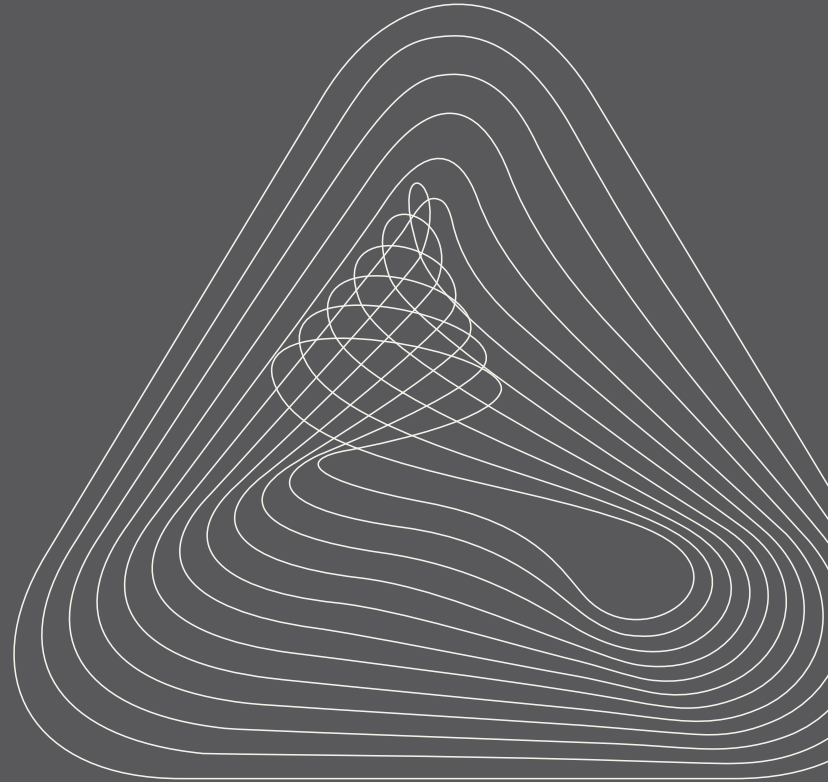
How RFID & NFC can help

- Track and trace every component in the supply chain
- Create an accurate bill of materials for vehicles
- Enable end users to check origin of aftermarket parts
- Improves management of market recalls



Connectivity summary

- Our performance tapes help ensure that touchscreens and other HMI components meet demanding requirements
- RFID enables technologies that authenticate product history, provide tracking and inventory solutions
- Our NFC-enabled labels can prevent components counterfeiting in the aftermarket

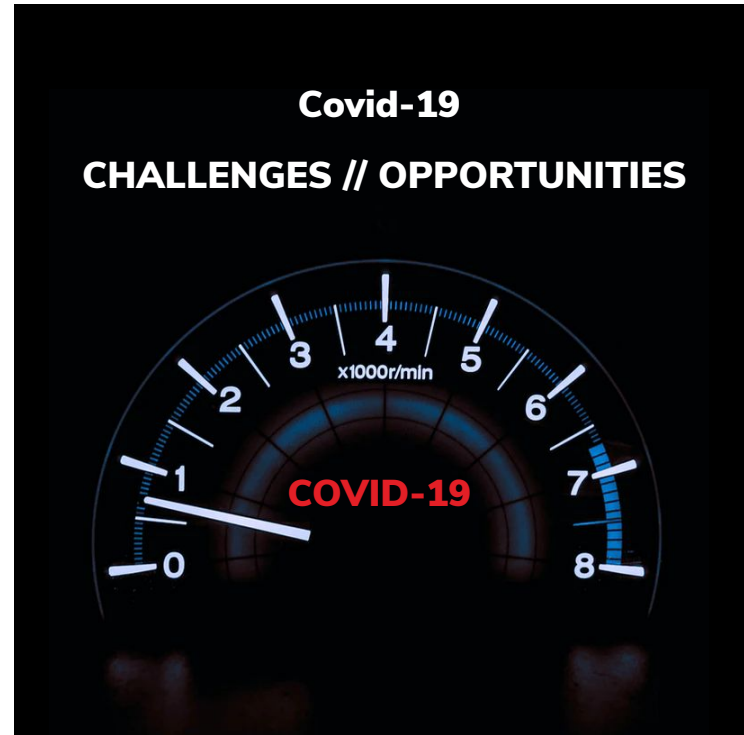


The impact of Covid-19 on our market

- Some regions shows that **Automotive industry has fallen 20-30%** in 2020 but we expect single digit growth in 2021
- **Despite current challenges we do see following opportunities:**
 - Higher interest in dual & local sourcing of our materials
 - Production and supply move from global -> local
- **Change in consumer behaviour:**
 - Shift to private owned vehicles for youngsters and female drivers; before Covid-19 not planning to own the car
 - After the virus spread studies shows there is the tendency towards owning vehicle and be more secured and protected

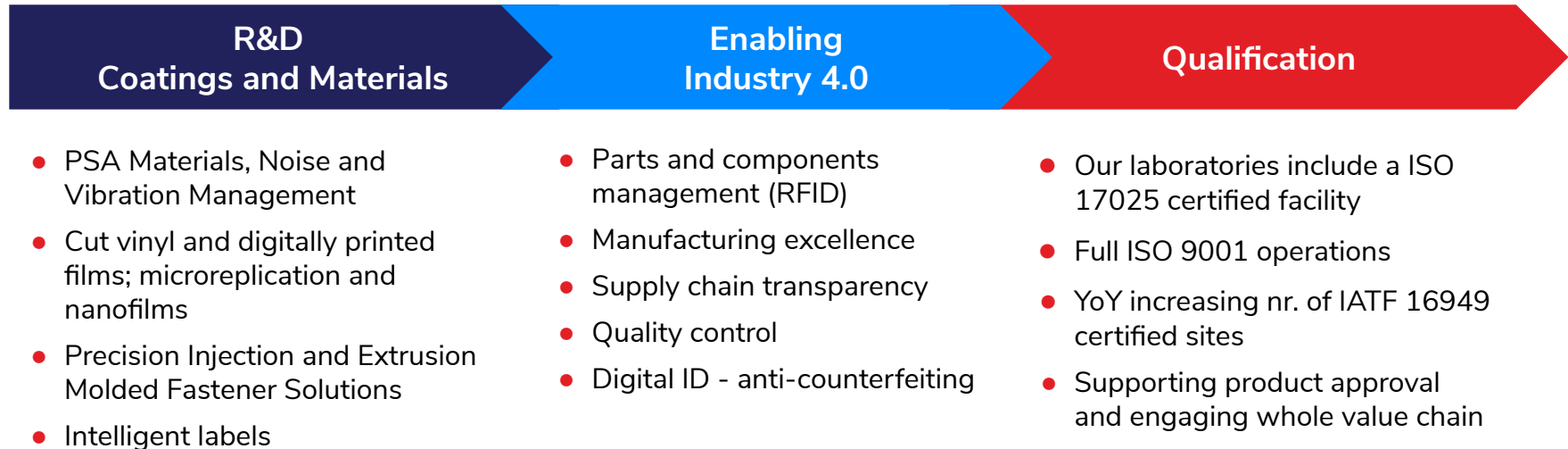
Source: [McKinsey & Company](#)

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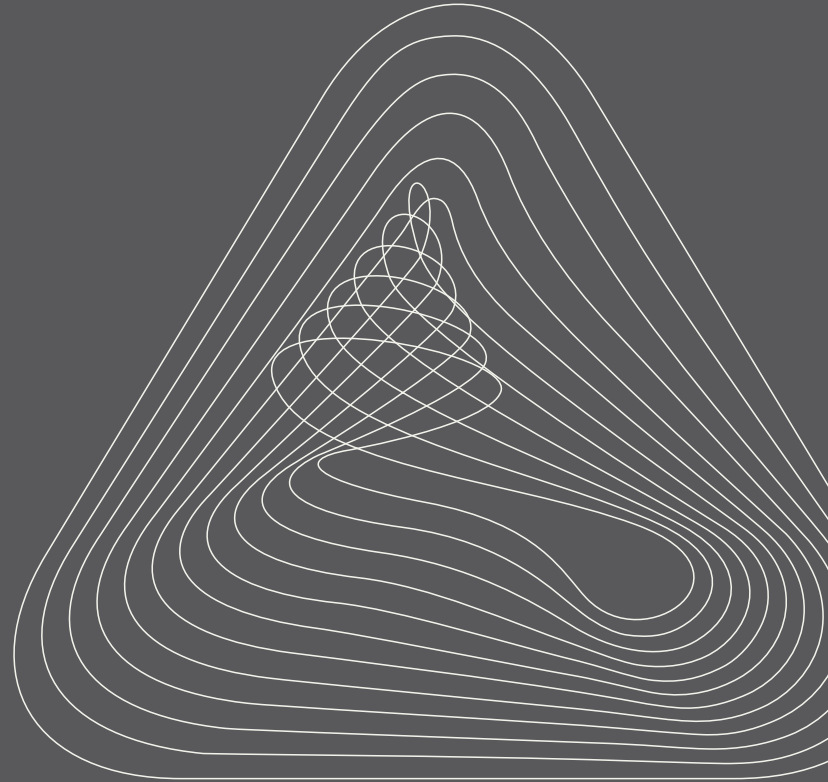
R&D Competencies to serve our Customers

The spirit of curiosity, new challenges in the marketplace and Avery Dennison's position as a global leader in the materials science industry drive us to develop and expand our core capabilities while introducing new material innovations and solutions for the world's manufacturers, converters and consumers.



With you for the whole ride.

Every Avery Dennison solution is accompanied by the expertise and support of a global technical team that knows and loves automotive.



Thank you



**AVERY
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