

IMPAXX

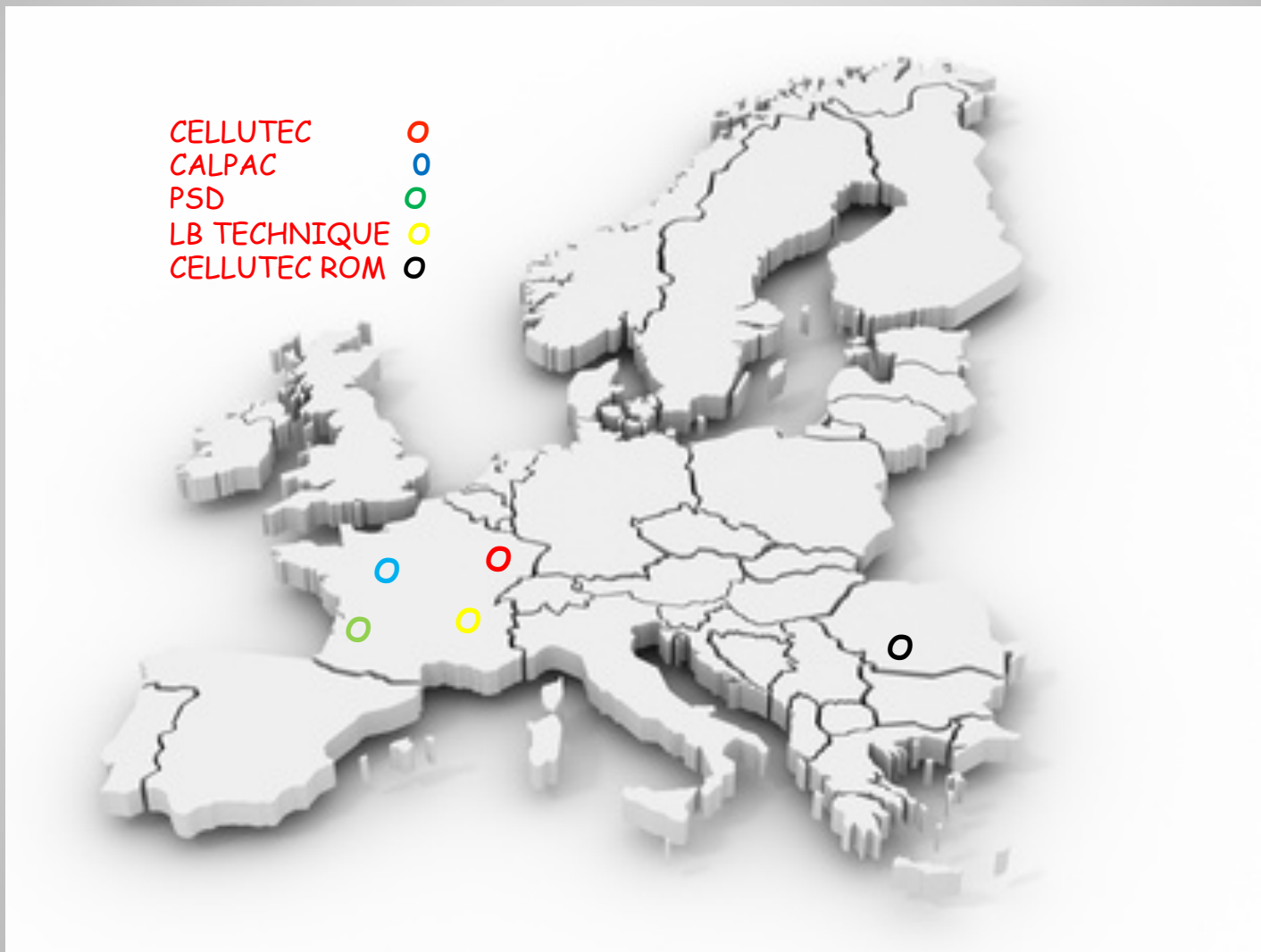
Energy Absorbers

by Cellutec

The Cellutec Group

- Personal introduction
- The Cellutec Group :
Industrial packaging and Energy Absorbers manufacturer, specialized in cellular foam transformation for tailor made packaging or technical parts.
- Created in 1980, in Alsace, East of France, near Germany and Switzerland.
- Focused on innovation: laser engraving, digital printing, cover skin, etc..
- 2011 : 180 people, 27 Mio € turnover
- 5 locations : 4 in France (HQ in Burnhaupt), 1 in Romania.

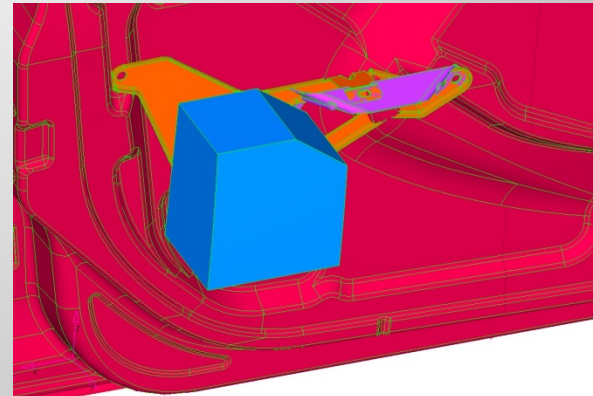
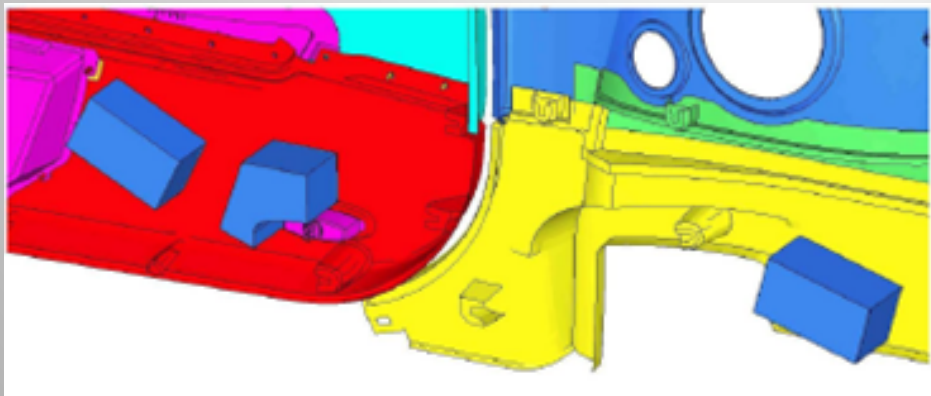
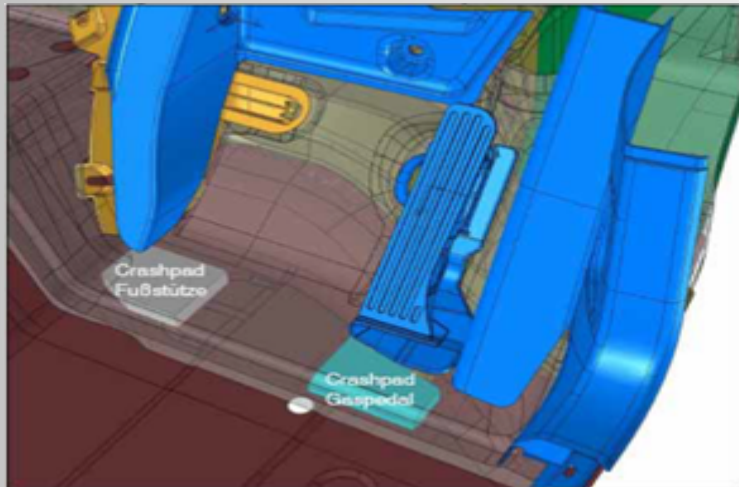
CELLUTEC GROUP LOCATIONS



History

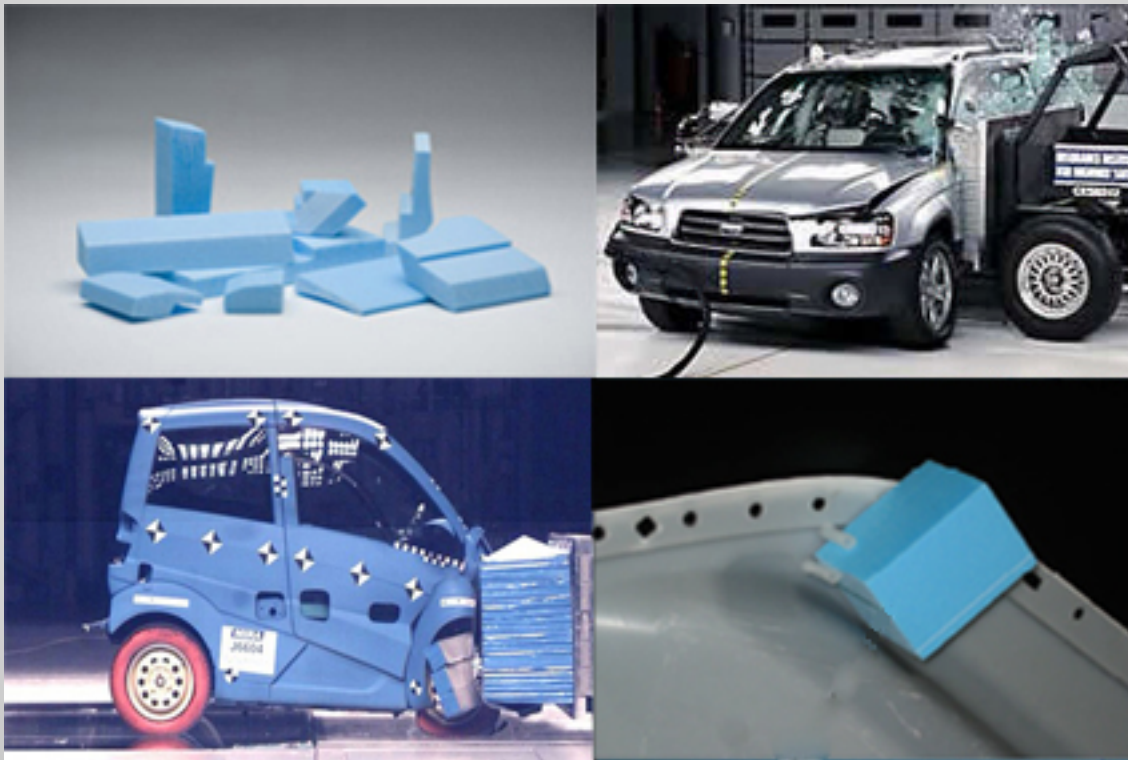
- Cellutec : subcontractor of DOW Automotive for IMPAXX EA since 2007.
- PSD Cestas (Bordeaux) : second subcontractor.
- 2011 : Cellutec takes over complete business with IMPAXX.
Licensed by DOW for Europe, Africa and Asia.
PSD is acquired by the Cellutec group.
- 2012 : Cellutec/PSD offers back-up in production of IMPAXX EA + complementary experience.
- 7 CNC wire cutters + 8 CNC milling machines.
- 1 designer at Cellutec + 1 designer at PSD focused on IMPAXX.

IMPAXX ENERGY ABSORBERS



Our mission:

Improving occupants safety
with less space, volume and costs.



Facts and figures (1/2)

- **Crash** : Shock which occurs on the road net between a vehicle (car, motorcycle, bicycle, lorry, bus, etc..) and another thing or person and which causes human and/or material damages.
- **Figures** (2005):

	EU	World
Population:	451 Mio	6.500 Mio
Deads in a crash / year:	40.000	1.3 Mio
- **European Union** (2007):

80% of deads are occupants of a vehicle: 60% drivers, 20% passengers
20% are pedestrians
- **Examples**: France and Germany (2008)

Country	Population	Crashes	Deads	Injured
France	65 Mio	76.800	4.443	96.905
Germany	82 Mio	91.100	4.477	70.644

Fact and figures (2/2)

- The bad news :
 - 80% of severe crashes due to driver' s behaviour
 - 50% due to an inadapted speed limit
 - 50% due to a loss of control of the vehicle
 - 27% due to excessive alcohol
 - 20% due to tiredness or falling asleep

- The good news :
 - Number of deads in EU in 2005 compared with 1970 : - 75%.
 - Tremendous development of active and passive safety

- **Example** : Germany (Statistisches Bundesamt)

	1970	2010	Trend
Crashes	1.392.000	2.411.300	+ 73%
Deads	19.193	3.648	- 81%
Injured	531.795	371.170	- 30 %

Energy absorbers for passive safety

- Energy absorbers dissipate the energy produced during a crash in order to protect the occupants of a vehicle.
- **What is IMPAXX?**
An extruded, closed cell, thermoplastic styrenic foam to maximize Energy Absorbers efficiency and minimize weight.
- Main protection aeras:
 - Door panel -> hip
 - Headliners -> head
 - Seat -> back
 - Stiring column -> knees
 - Foot rest/floor -> ankle

Application / Protection areas



Head Impact
FMVSS 201U



Frontal Impact
FMVSS 208, ECE 95, IIHS, NCAP



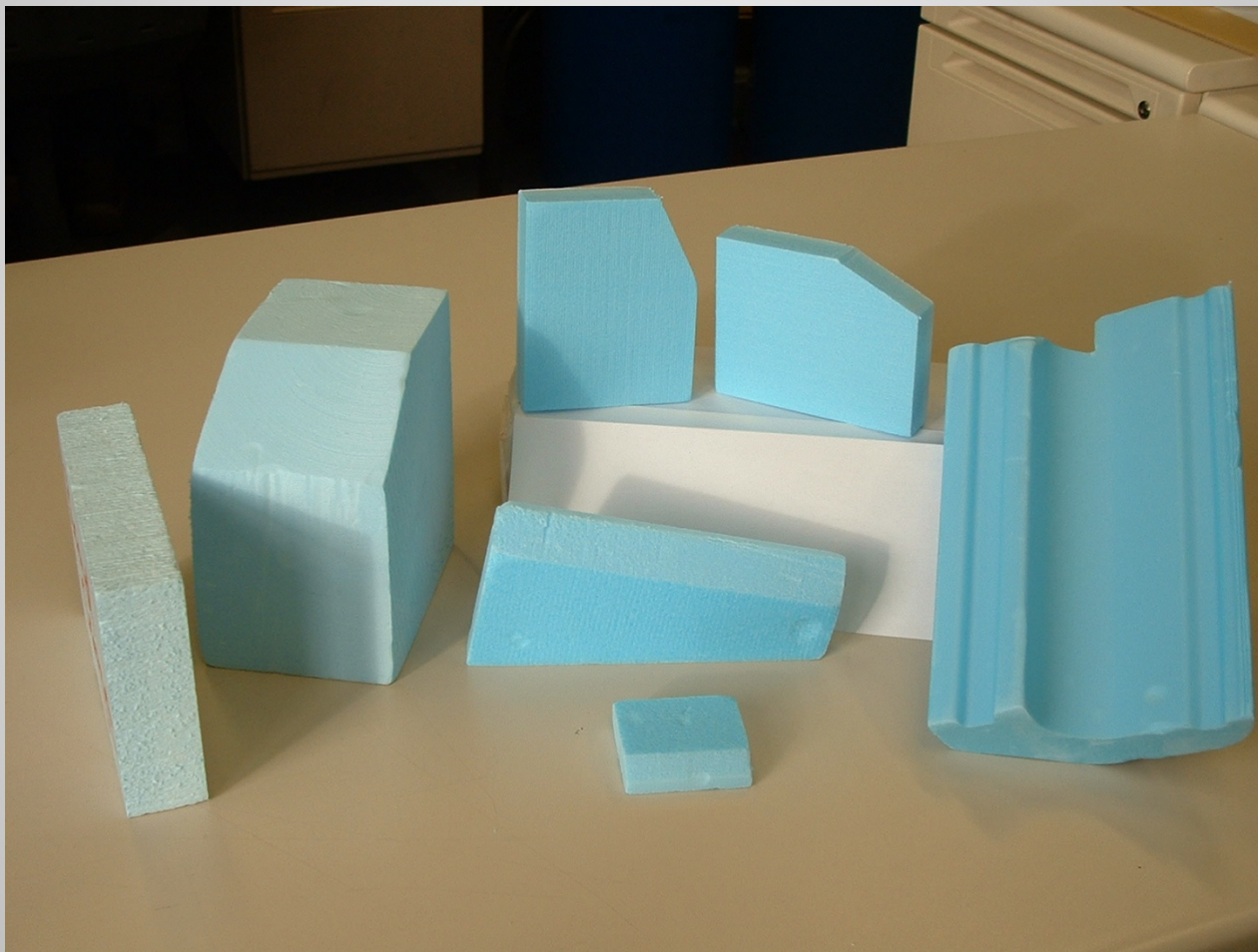
Side Impact
FMVSS 214, ECE 95, IIHS, NCAP



Pedestrian Impact
EEVC/CEVE WG17

**APPLICATION
AREAS**

Examples of IMPAXX Energy absorbers



What is IMPAXX?

IMPAXX* is a highly engineered styrenic thermoplastic closed-cell foam comprised of:

- *Environmentally friendly blowing agent*
 - *Non-HCFC*
- *Recyclable feedstock (e.g. thermoplastic)*
- *Engineered additive package:*
 - *Flame retardant*
 - *Nucleating agent*
 - *Fillers*
 - *Colorant*
- *Single-screw extrusion manufacturing process*
 - *Produced on world-class assets*
 - *Globally available product offering*



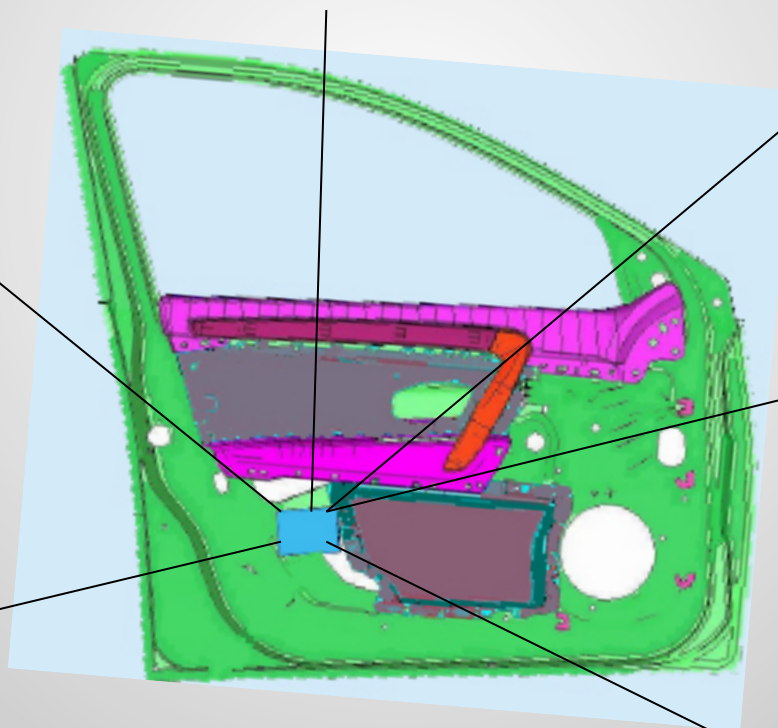
Main technical features

HIGH IMPACT RESISTANCE

Absorbs more energy within less time than plastic molded parts
(EPP, EPS or PU beads)

SPACE REDUCTION
required for the EAC
about 30%

SELF EXTINGUISHING
Resistant to fire, IMPAXX
goes out of himself in case
of fire (FMVSS 302)

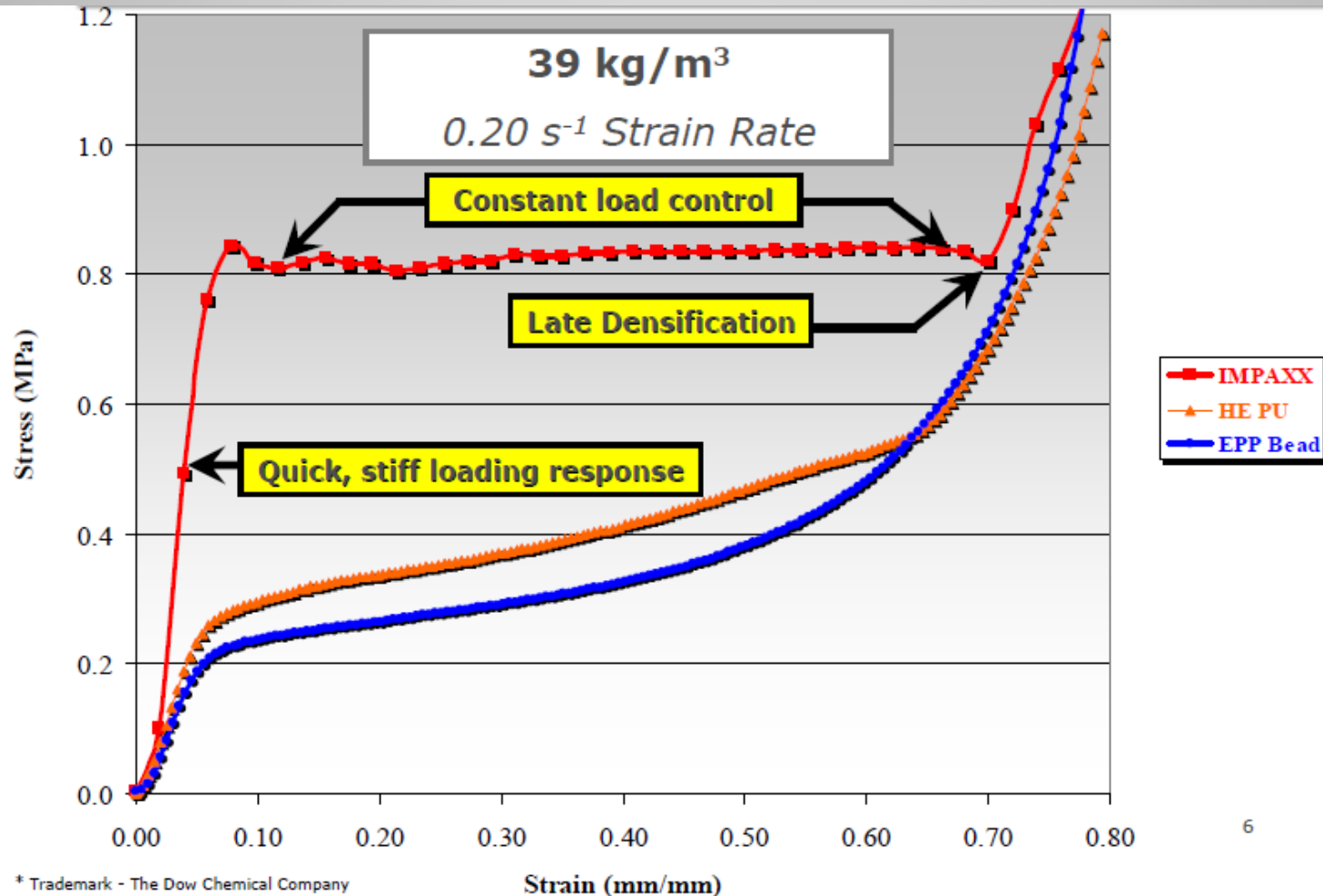


WEIGHT REDUCTION
of the absorber
about 30% to 50%

**STABLE IMPACT
RESPONSE** all over
the temperature
range [-40°C; +80°C]

TOTALLY RECYCLABLE

Comparing EA efficiency



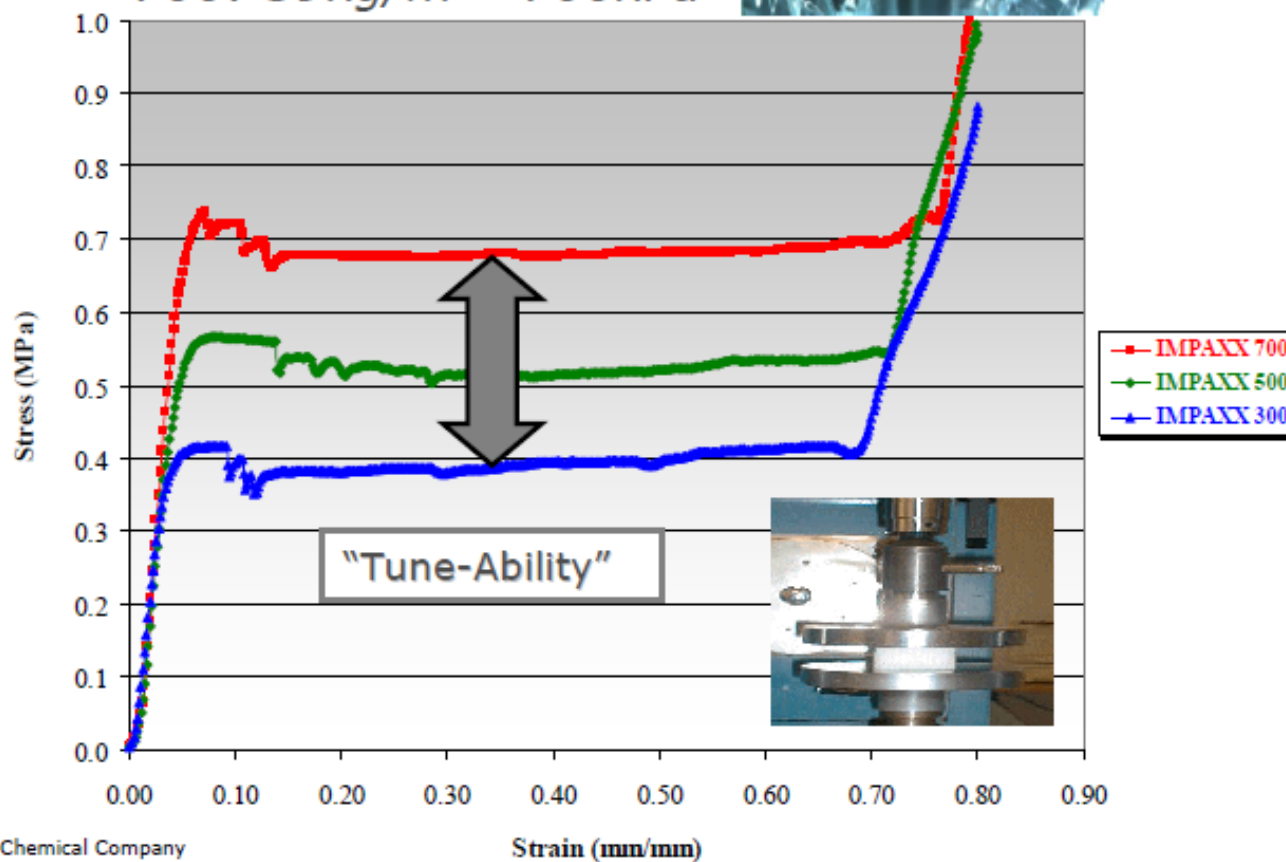
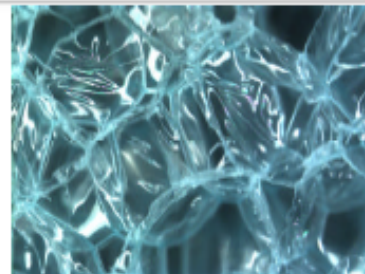
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The same volume/density absorbs 2 x impact energy vs conventional solutions.

Comparing IMPAXX 300, 500 and 700

IMPAXX* EA:

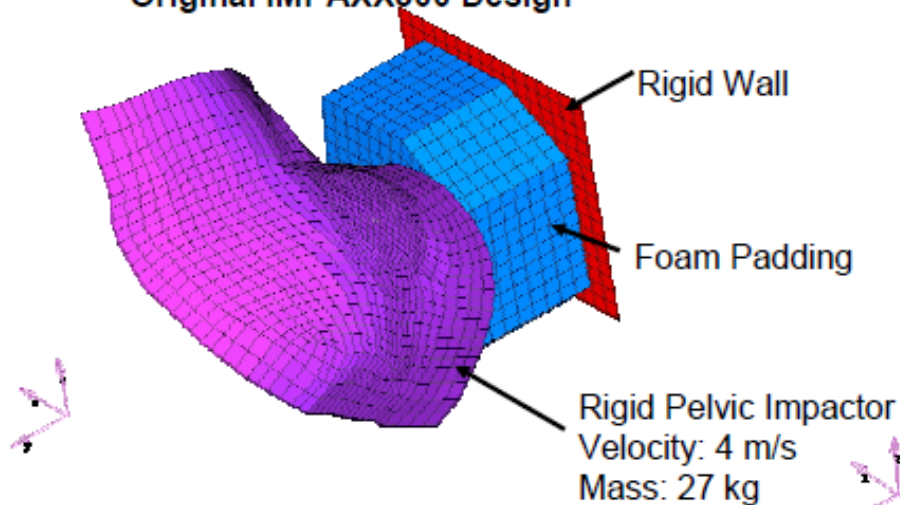
- 300: 34kg/m³ - 400kPa
- 500: 37kg/m³ - 550kPa
- 700: 39kg/m³ - 700kPa



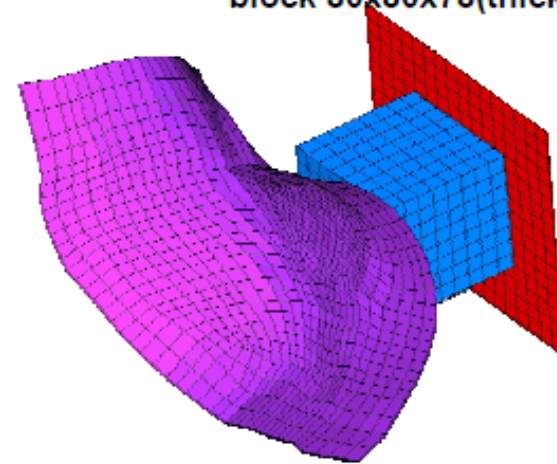
Comparing IMPAXX 300 and IMPAXX 700

Design Improvement Proposal: IMPAXX700 vs. IMPAXX300

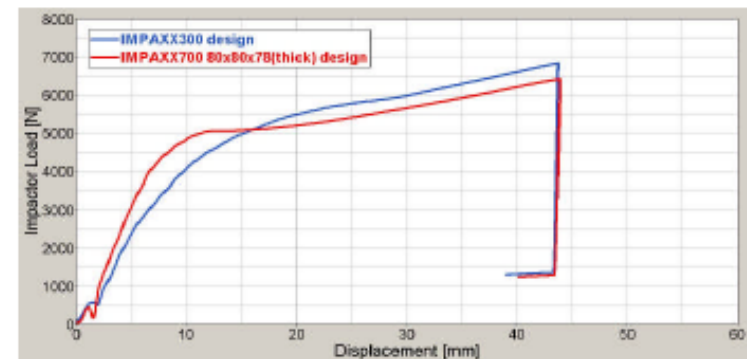
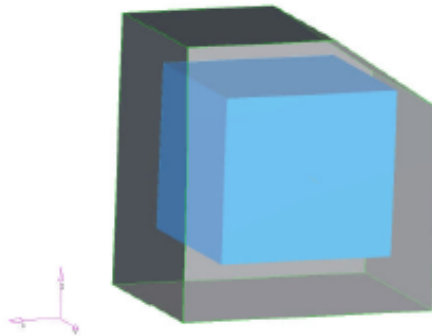
Original IMPAXX300 Design



Optimised IMPAXX700 Design:
block 80x80x78(thick)



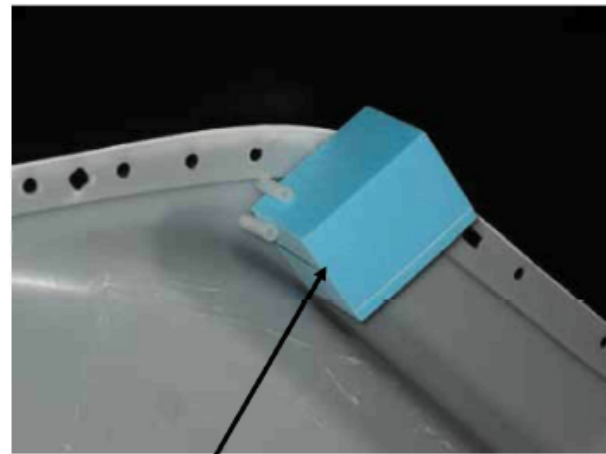
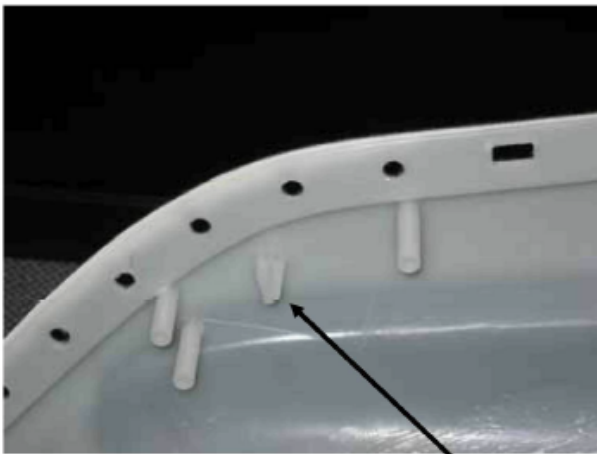
IMPAXX300 vs IMPAXX700 Design



Assembling IMPAXX

- Different methods are possible :
 - **Gluing** with polyolefin Hot Melt adhesives
 - **Assembling** with double-sided pressure sensitive adhesive tapes
 - **Pushing on** trims/brackets molded in part to be assembled on

SMART ForTwo Example



Foam block pushed on cross rib

High efficiency Energy Absorber

- **Legal requirements** compliance (e.g. ECE norms)
- **Higher rating** in consumer testing :



- **Less space** required for the Energy Absorber (up to 30%), which is more comfort available to the vehicle occupants (head space, knee space, etc..) and more design freedom.
- CAE and FE modelling with LS Dyna, Pam Crash and RADIOSS.

Saving time and money

- **Low development time and cost :**
 - Prototypes made on production machines
- **No tooling required :**
 - CNC abrasive or hot wire cutting process technology
 - No investments costs
 - Immediate response to design changes
- **Low production leadtime : 3 to 4 weeks.**
- **Optimized plank length to minimize scrap.**

Some references



Formula Student

- **1981** : The Society of Automotive Engineers (SAE) in the United States starts running its **Formula SAE** programme.
- The world's **largest student motorsport competition**.
- Backed by industry and high profile engineers such as Ross Brawn.
- To inspire and develop enterprising and innovative young engineers.
- Universities from across the globe are challenged to **design and build a single-seat racing car** in order to compete in static and dynamic events, which demonstrate their understanding and test the performance of the vehicle.
- A record **134 student teams from 34 countries** registered for Formula Student 2012.
- Last year's winning car, from the University of **Stuttgart**, boasted a better brake horsepower (bhp)/weight ratio than a Bugatti Veyron.

Formula Student



FSAE Impact Attenuator 11

IMPAXX recommended for the crash nose = IA-11



Future developments

1) Helmets :

improving safety of helmets with dedicated blocks placed at critical areas : top, side, front and back.

->The risk is 6x higher to die on motorcycle than by car.

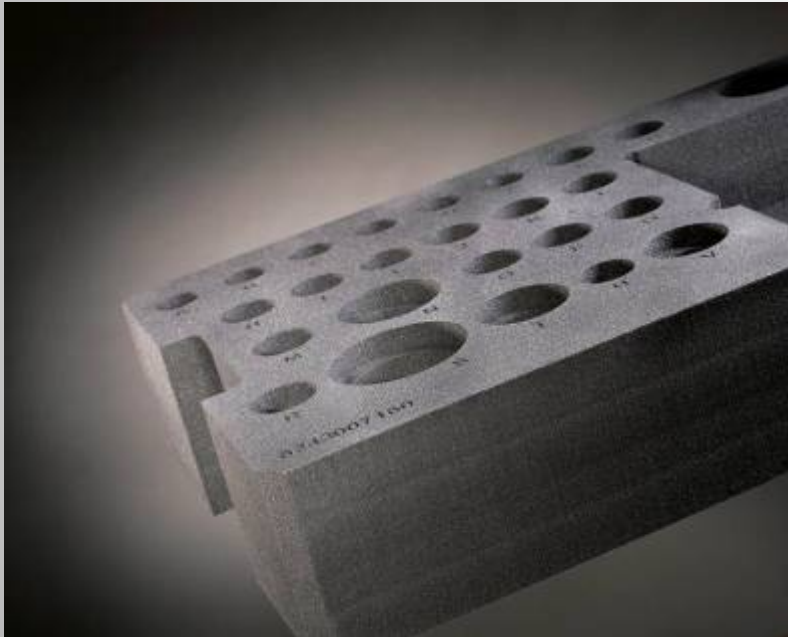
2) Children Seats :

400 children died in Switzerland in 2011 within a car because of unsafe seating.

-> reinforce children seats at critical areas.

Remember : IMPAXX can be foamed with PU, PS or PE.

PACKAGING FOR INTERIOR PARTS AUTOMOTIVE: MULTI WAY PACKAGING



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AUTOMOTIVE: MULTI WAY PACKAGING



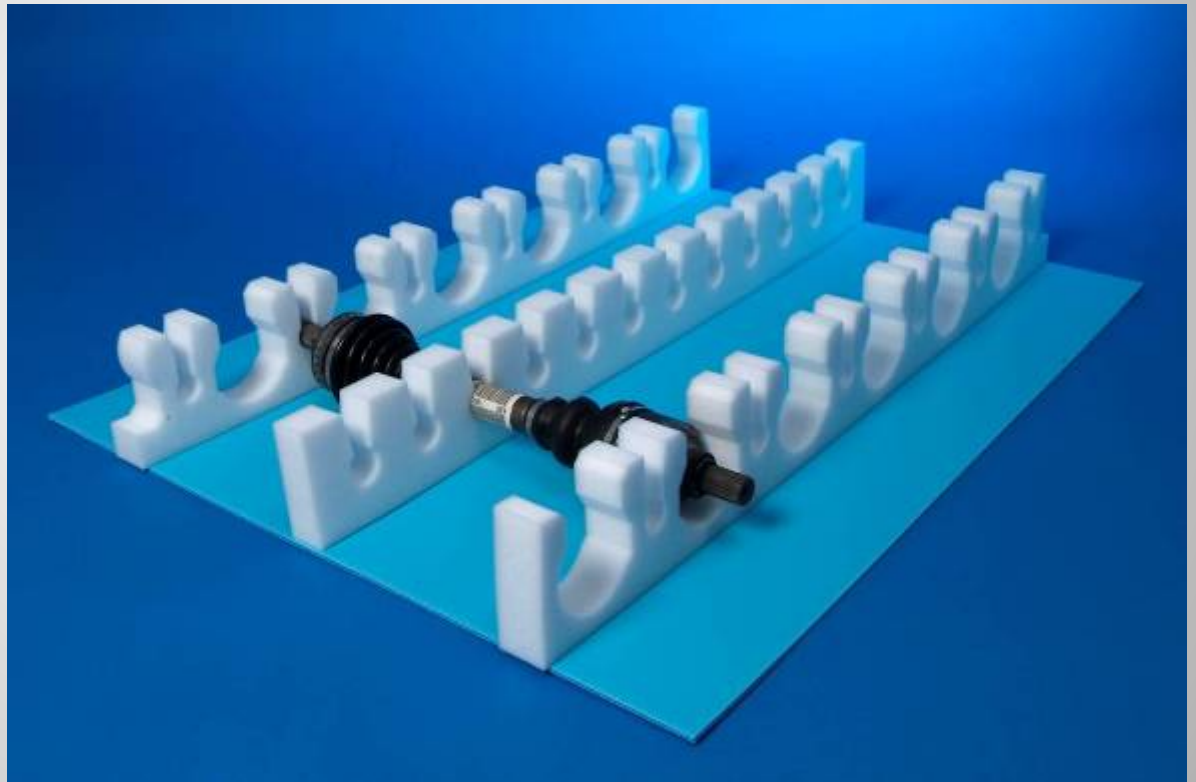
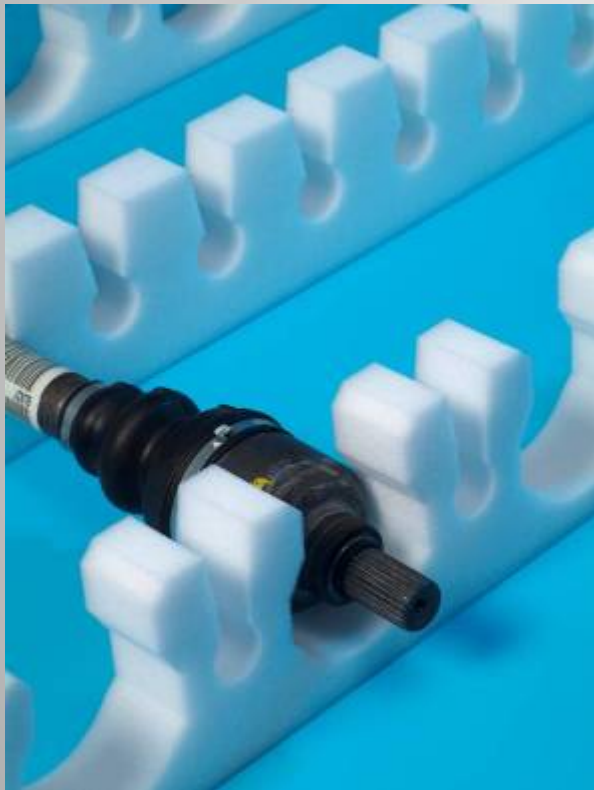
AUTOMOTIVE: MULTI WAY PACKAGING



AUTOMOTIVE: MULTI WAY PACKAGING



AUTOMOTIVE: CKD



AUTOMOTIVE: SPARE PARTS



LUXURY and COSMETICS



LUXURY: WINE & SPIRITS



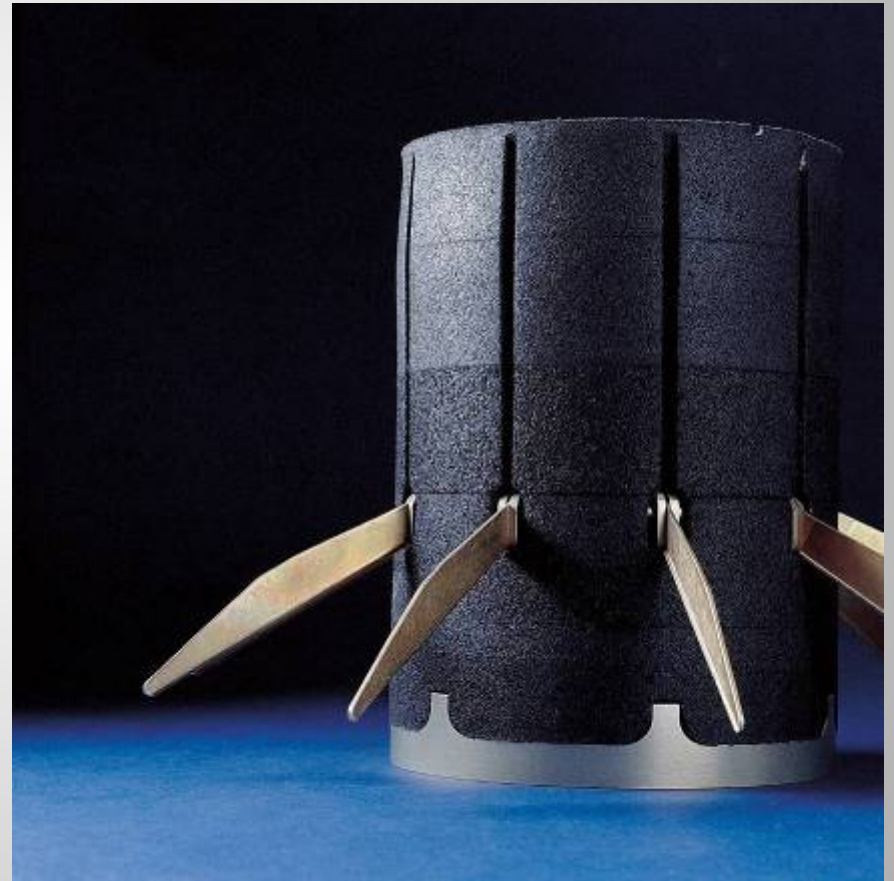
LUXURY: WINE & SPIRITS



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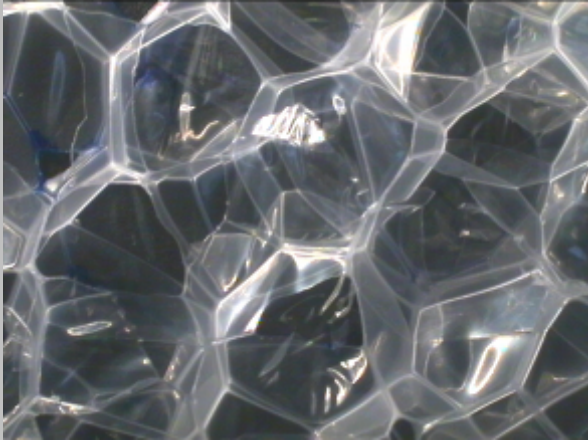
MILITARY



AERONAUTICS



ACOUSTIC INDUSTRY



RECYCLING



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