



Cellasto® - Innovative Solutions for the Automotive Industry

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Application Development and Vehicle Dynamics

Cellasto® - Innovative Solutions for the Automotive Industry

Cellasto® Jounce Bumpers

- 50 Years Know-How and Experiences!

BASF
The Chemical Company



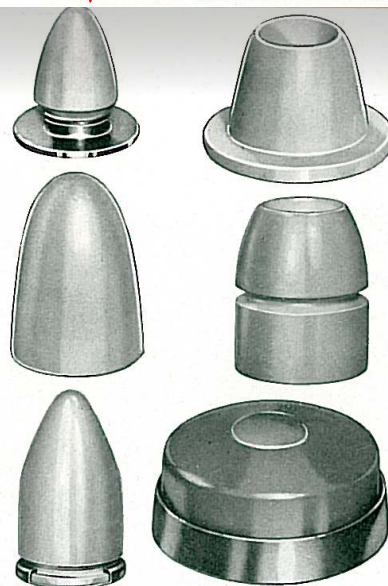
**lemförder
kunststoff**

**PU Solutions
Elastogran**

FEDERKÖRPER



Cellasto-Kranpuffer
bis P = 200 to



Zusatzfedern für Fahrzeuge



BASF
The Chemical Company

Cellasto® - Innovative Solutions for the Automotive Industry

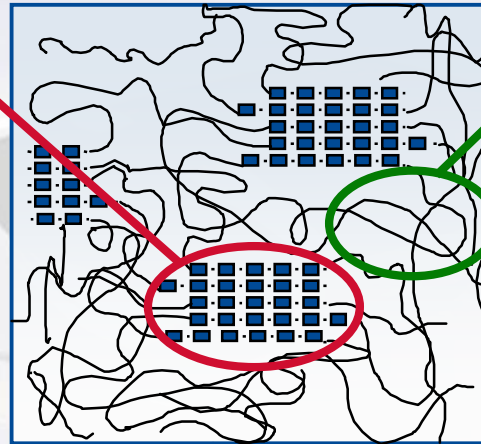
Innovative Cellasto® Solutions for the Automotive Industry

BASF
The Chemical Company

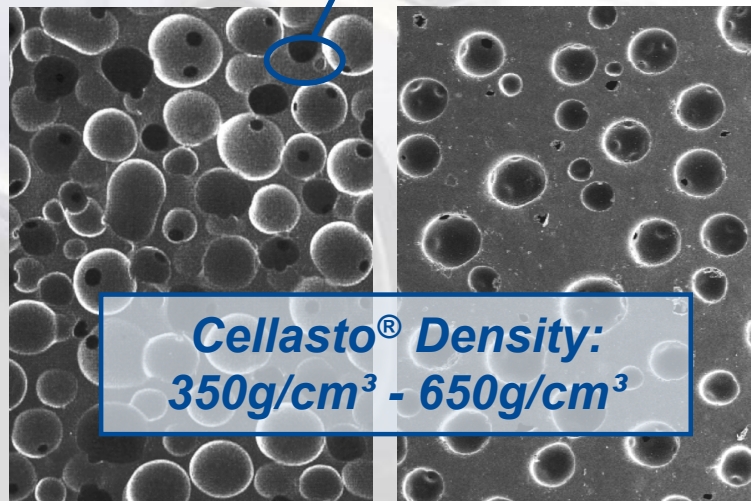


Cellasto® Characteristics: Chemistry

- Rigid segment formed by chemical chain extension of isocyanates caused by urea groups
- Physical cross-linking caused by crystalline structure
 - Static and dyn. setting
 - Heat stability



- Soft segment formed by chemical chain extension of polyols caused by urethane groups
- Flexibility
- Cold flexibility



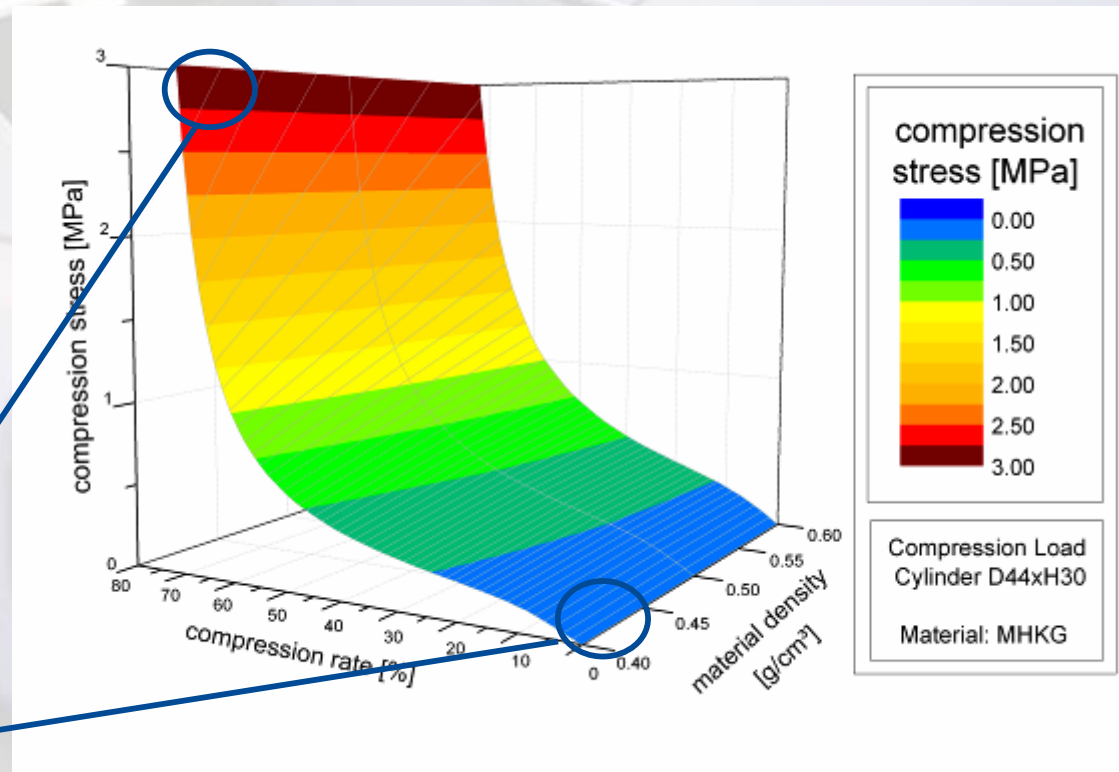
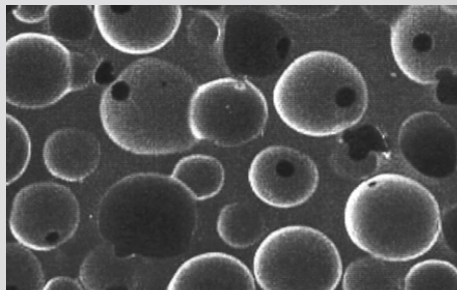
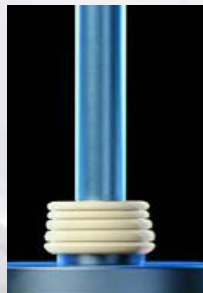
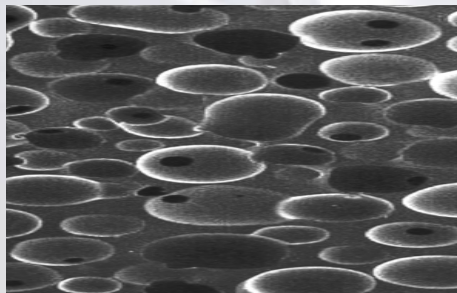
Microcellular structure
inside a foamed
Cellasto® part

Microcellular structure
of the mold skin of a
foamed Cellasto® part

Cellasto® Characteristics: L/D Behavior

■ Progressive Cellasto L/D characteristics depends on

- material density,
- shape factor and
- encapsulation (preventing lateral deflection)



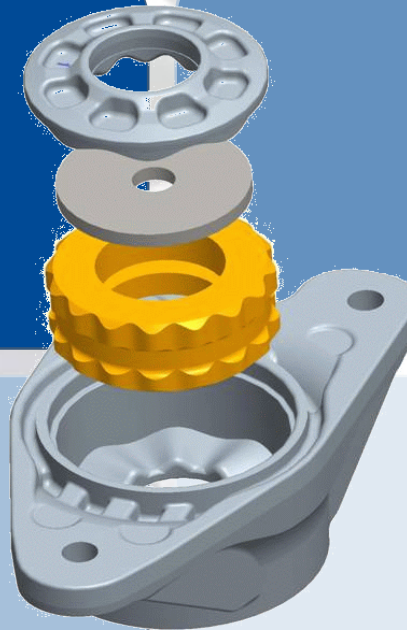
Customer's Demand for Cellasto® Parts

Ride Comfort

Acoustic

Light Weight

Costs

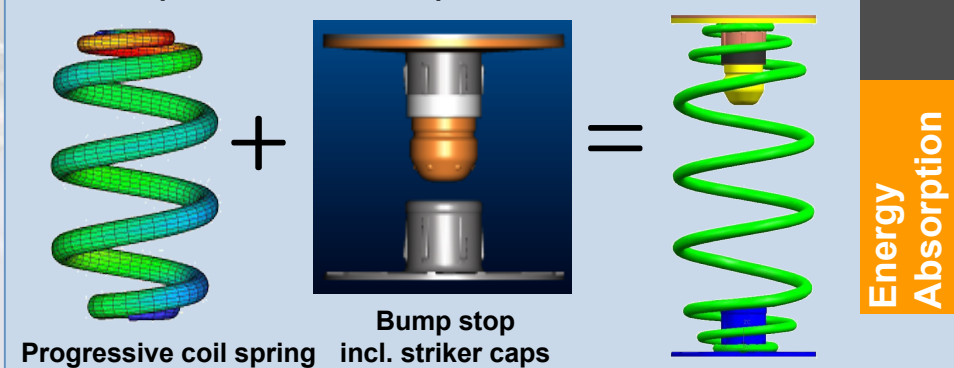


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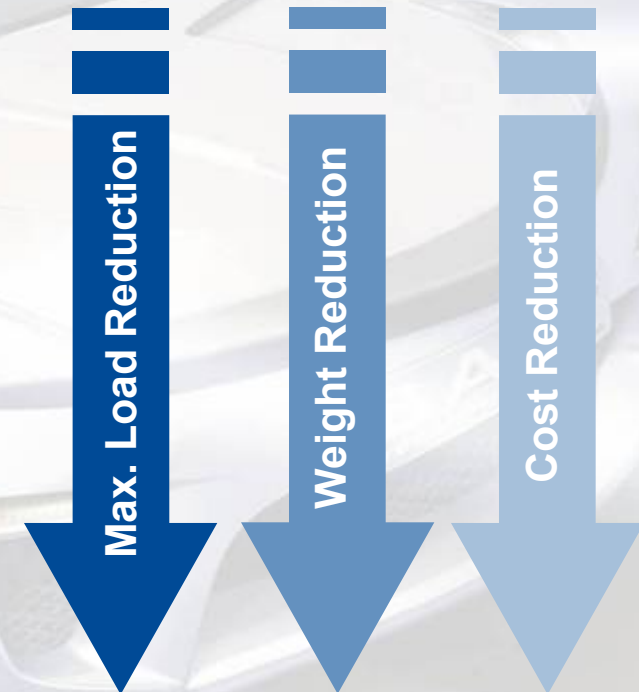
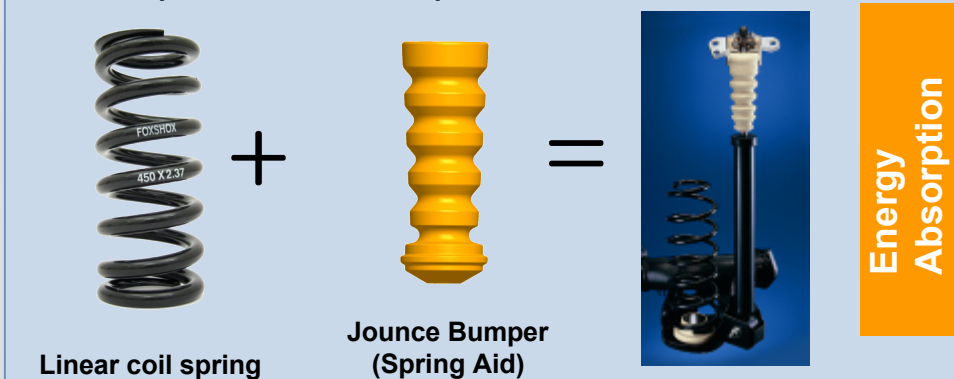
Jounce Bumpers - Influence of suspension concept regarding cost & weight

Light Weight

■ Suspension concept : PCS + BS



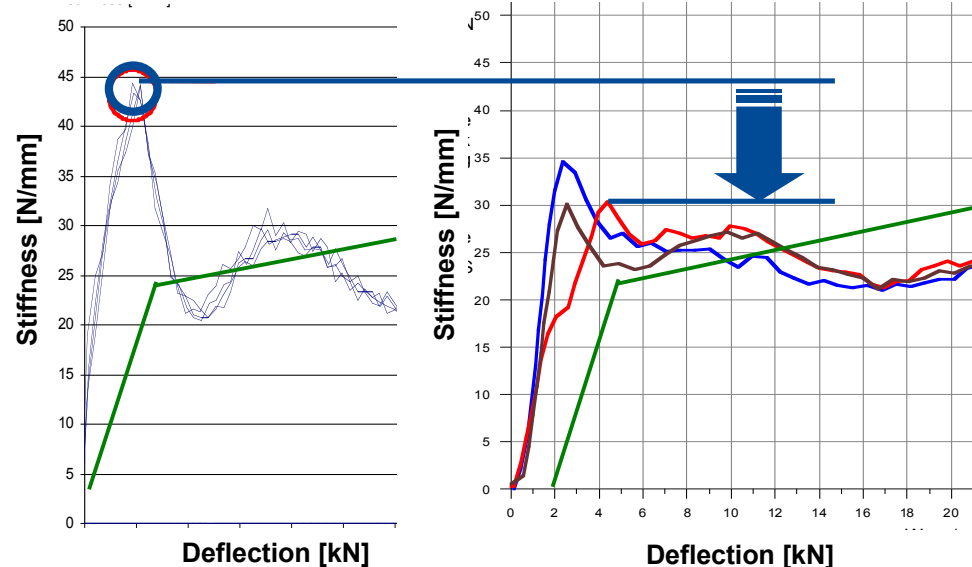
■ Suspension concept : LCS + JB



Jounce Bumpers – Stiffness Optimization

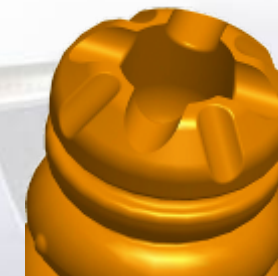
- Soft touch point for seamless transition into operating area of Jounce Bumper
 - no relevant stiffness decrease during compression stroke
 - soft initial stiffness
 - benefit for a better absorption of ground waves
 - improvement on comfort

Ride Comfort



Stiffness optimized design of grooves

Bending lip for soft touch point



Flower design lip for soft touch point



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Jounce Bumpers and Bump Stops– New Assembling Concepts with Elastolit®



Light Weight



Elastolit® spacer
with snap-fit



Angular Elastolit® carrier
with embedded bolt

- The combination of Cellasto® with the mold casted BASF PU durometer Elastolit® offers high potential in reducing part weight by partial or complete substitution of metal
- Bonding between Cellasto® and Elastolit® ensures a permanent fixing of the Cellasto® bumper and simplifies mounting

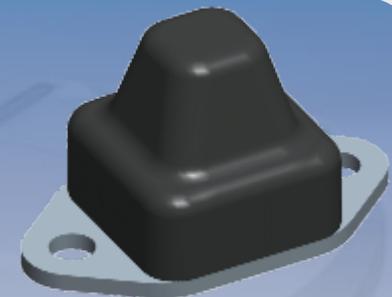
74g

-75%

18g

-85%

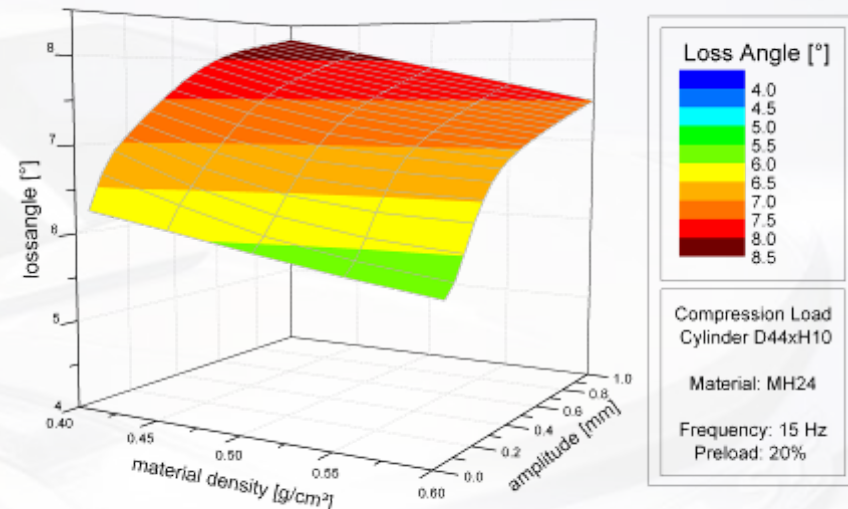
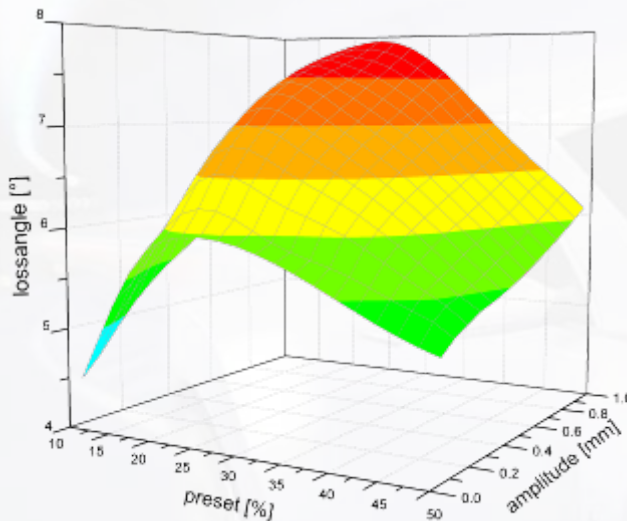
11.5g



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Cellasto® Characteristics: Dynamic Behavior

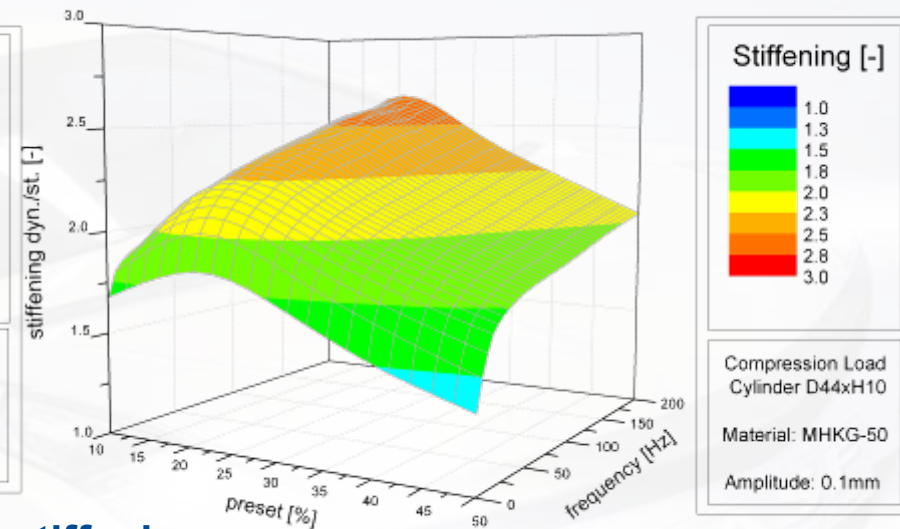
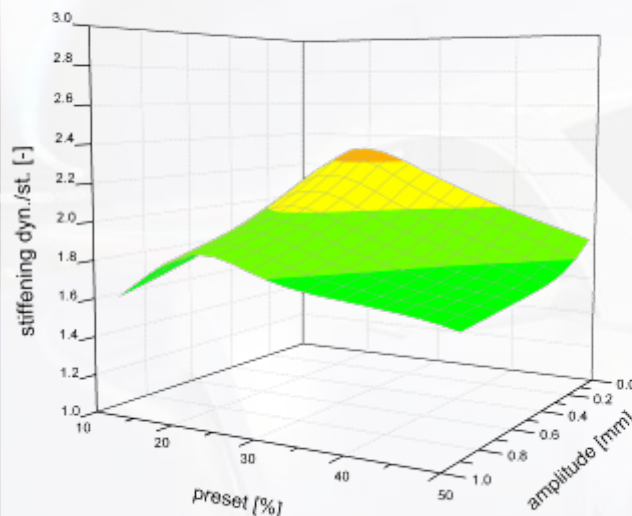
Ride Comfort



- Amplitude dependant damping
 - Increased loss angle at large amplitudes, dependant on compression rate and material density
 - Effective damping of vibrations, e.G. frequency response of wheel or coil spring ⇒ relevant for top mounts and coil spring isolators
- ⇒ Improved ride comfort

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Cellasto® Characteristics: Dynamic Behavior



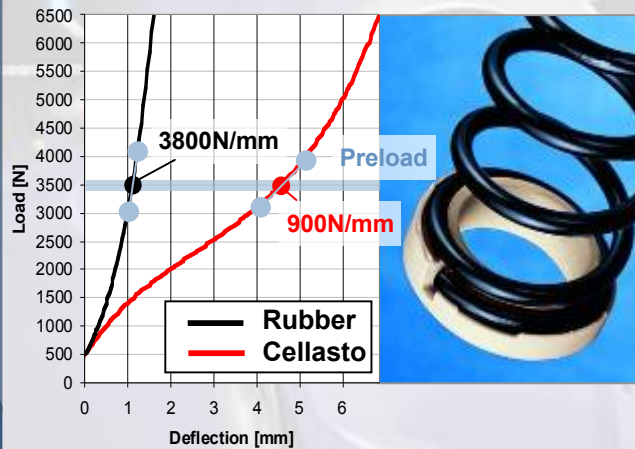
- **Frequency and amplitude dependant stiffening**
 - Next to the good damping behavior Cellasto® offers low dynamic stiffening rates at high frequencies and small amplitudes, dependant on compression rate and material density
 - Effective isolation of high frequency noise, e.G. chuckle noise of shock absorbers or whine noise of differential gears
- ⇒ **Improved acoustic**

Cellasto® Coil Spring Isolators

Acoustic

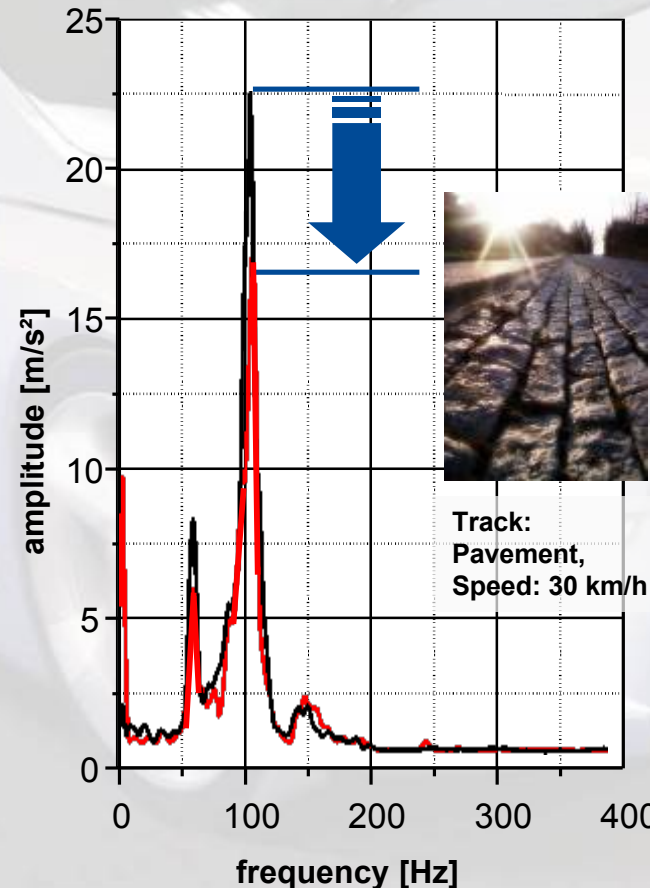
Ride Comfort

Static Load Deflection Characteristics

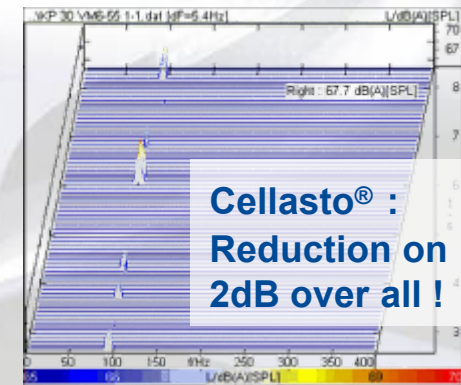
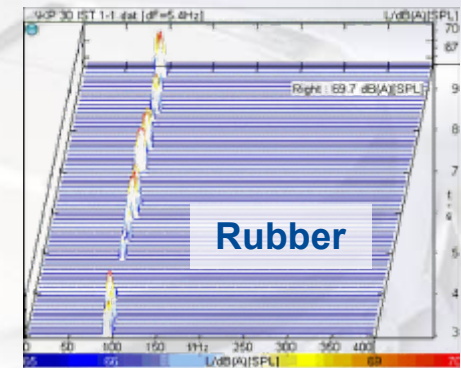


A lower base stiffness combined with a reduction of vertical acceleration leads to more comfort and to a better acoustic performance!

Road Noise: Vehicle results Acceleration at coil spring, vertical direction



Noise Measurement Measurement position: Driver seat



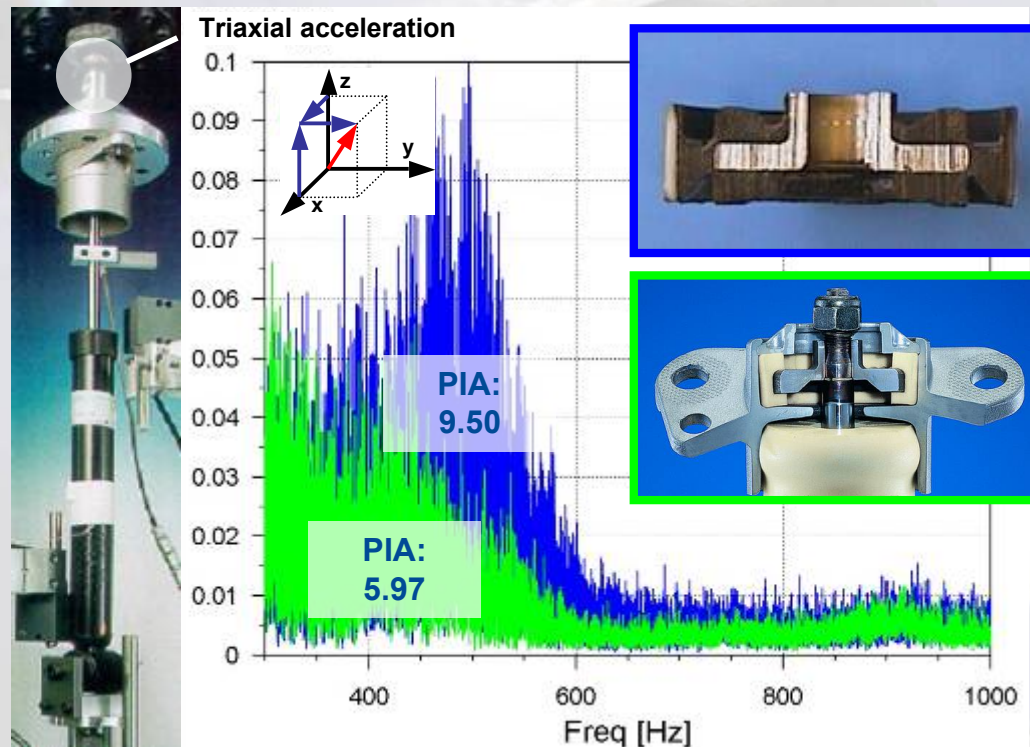
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Cellasto® Top Mounts – Chuckle Noise Prevention



System Bench Test

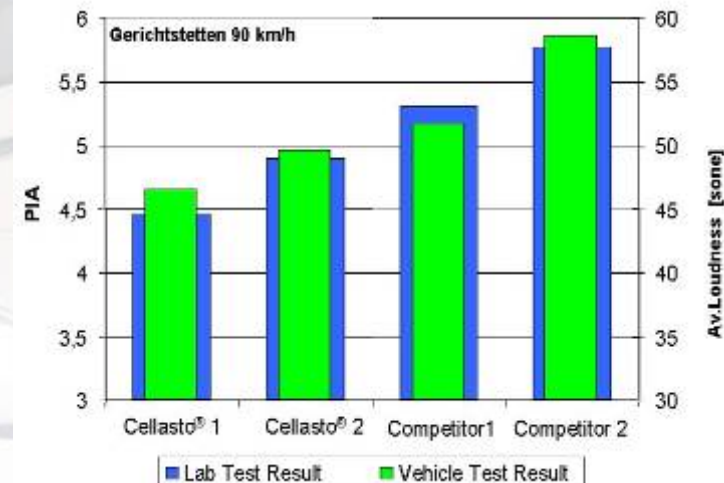
Excitation: Real signal wavy tar road



Integration of frequency analysis
⇒ PIA Value to evaluate chuckle noise

Road Noise: Vehicle results

Subjective validation



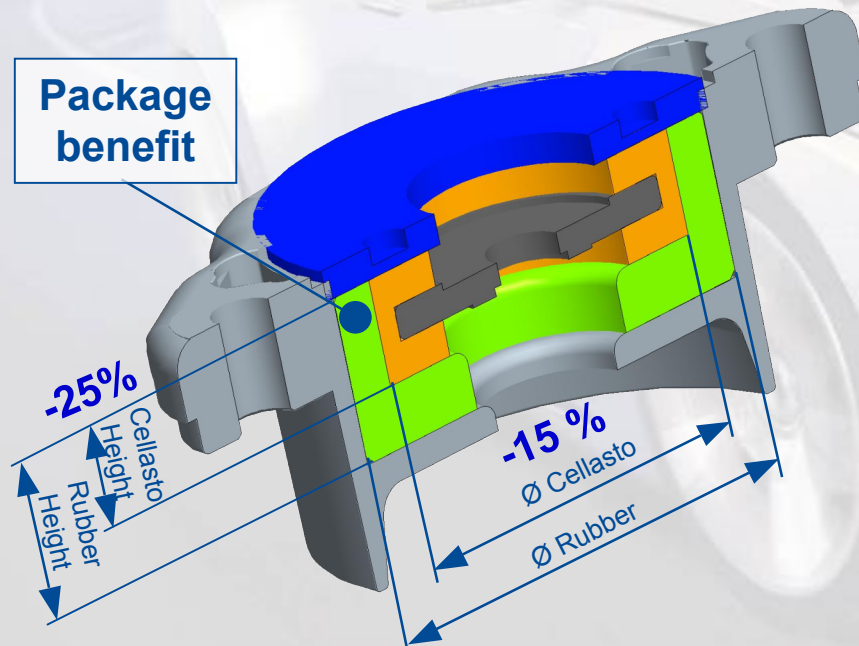
PIA value correlates well with the psycho acoustic loudness in vehicle test

⇒ Improvement of subjective sensation

Cellasto® Top Mounts - Package

- Cellasto®'s volume compressibility allows smaller housing dimensions and therefore better package and weight performance in comparison to a conventional rubber top mount.

Light Weight



400g



-25%

300g

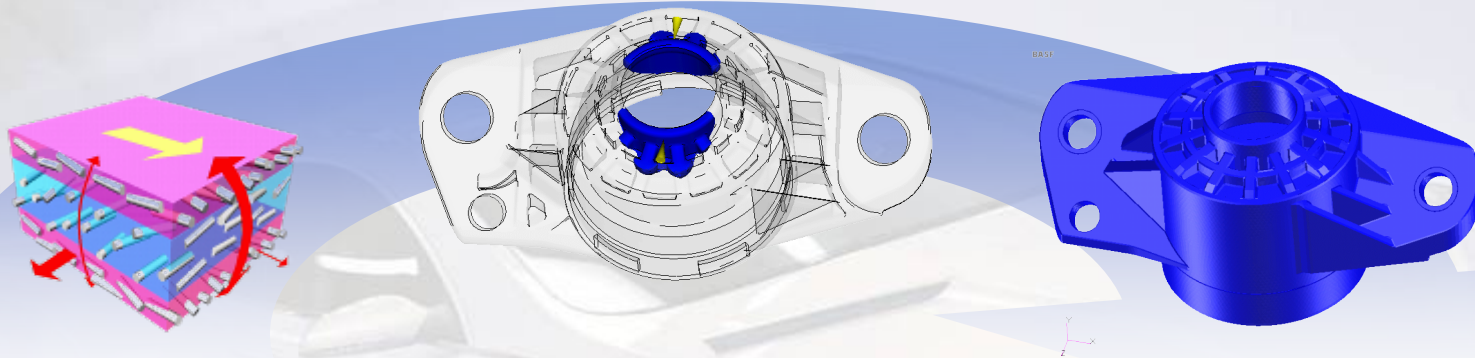


-43%

230g



Cellasto® Top Mounts - Future Trend



Light Weight



Aluminum
Die Cast
Housing

- **Benefits:**
 - Weight reduction
 - Improvement on NVH
 - No corrosion
 - Improvement on assembling process
 - Integrative Simulation
⇒ optimized structural analysis to consider the fiber orientation

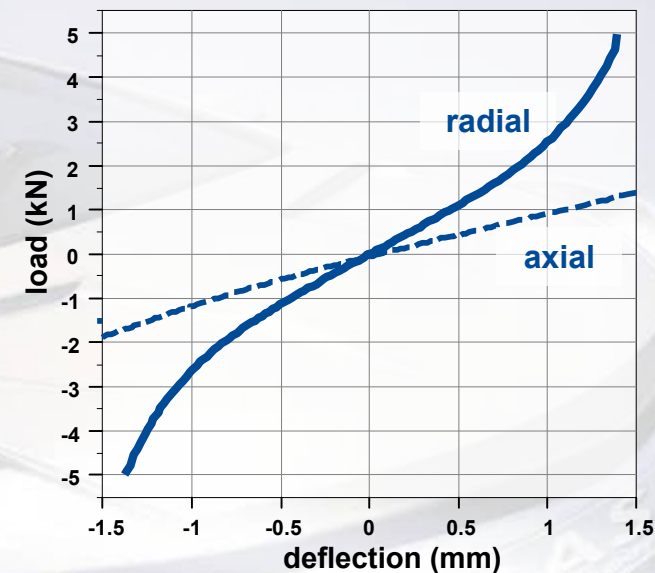
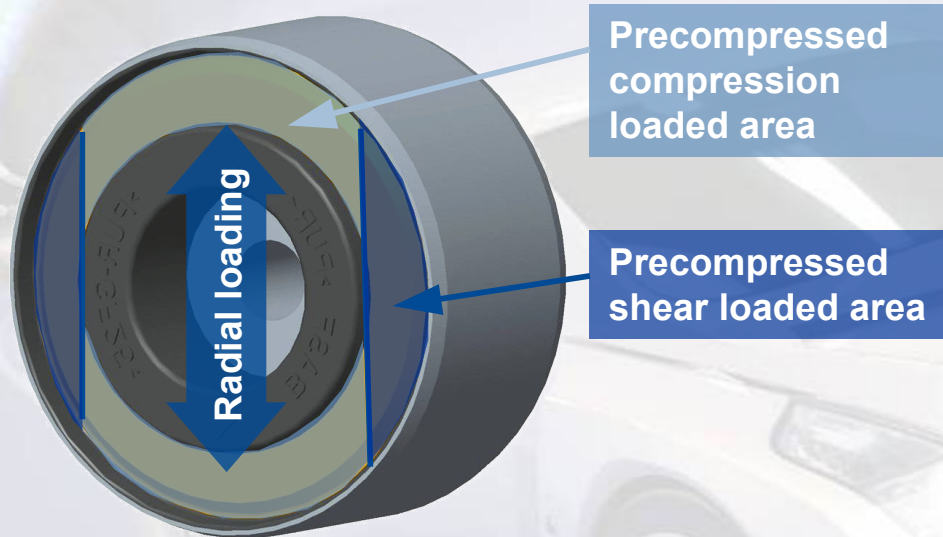


Ultramid®
Die Cast
Housing

Cellasto® Bushings - Characteristics

Acoustic

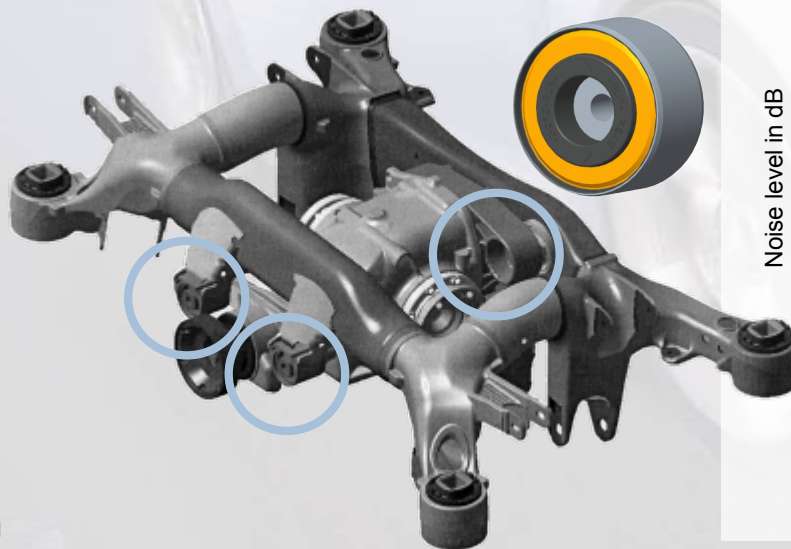
Ride Comfort



- **Characteristics of Cellasto® Bushings:**
 - Progressive L/D characteristics with soft initial stiffness
 - Combination of compression and shear loaded areas to adjust target characteristics
 - High load capability
 - Amplitude dependant damping and low stiffening at small amplitudes ⇒ good compromise between comfort and acoustic

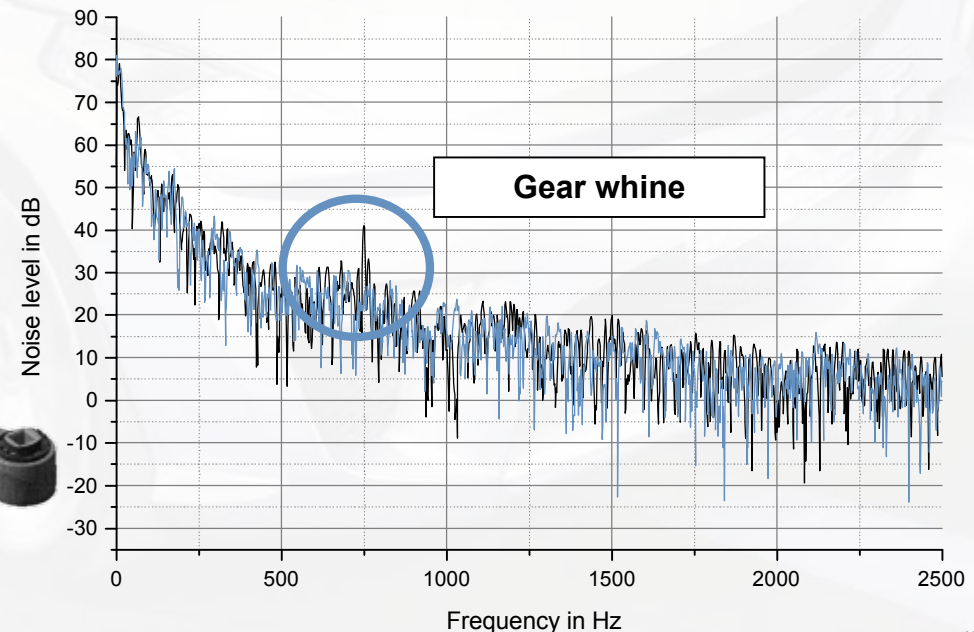
Cellasto® Bushings - Characteristics

- **Example Cellasto Differential Mounts**
 - **Lower stiffness level combined with high load capability leads to an improved acoustic behavior and an improved durability performance**



Road Noise: Vehicle results Noise level at 140 km/h (FFT)

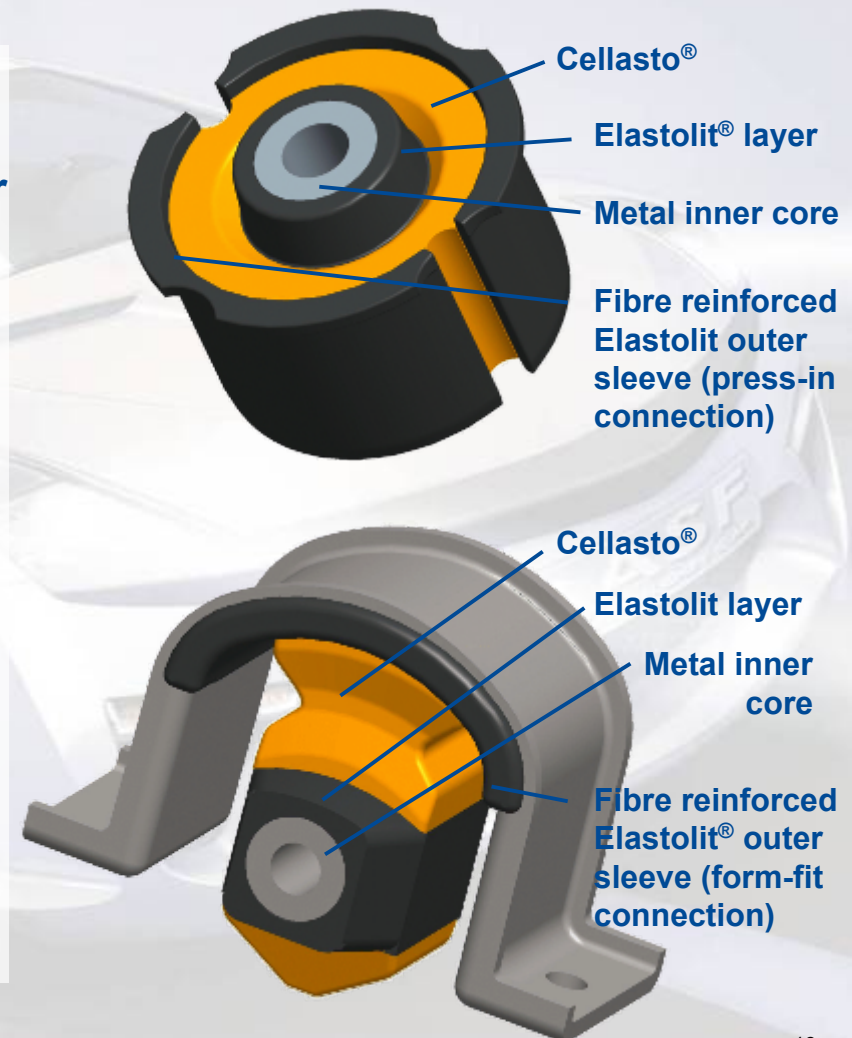
■ Cellasto
■ Rubber



Cellasto® Bushings – Potential of Elastolit®

Light Weight

- The use of the mold casted BASF PU duromer Elastolit® for the connection of Cellasto with metal parts like bushing inner cores or outer sleeves offers high potential in reducing part weight by partial or complete substitution of metal (e.G. minimum bushing core outer diameter for holding torque)
- Support of multi-axial loads by force-fit or form-fit connections
- Fiber-glass reinforced Elastolit® with high stiffness to realize supporting structures
⇒ High design flexibility
⇒ Elastolit® outer sleeves and snap-in solutions possible



Cellasto® - Potential for Cost Reduction

Costs

- Cost reduction by
 - Package reduction
 - Weight reduction
 - Right material selection
 - Improved performance
 - Proximity to automotive customers with six sites and global key account teams

⇒ Advantages of Cellasto® has to be regarded within the whole system !

 **Cellasto® MHKG** – NDI based closed cell formulation

- Formulated for excellent cold temperature performance

2. **Cellasto® MH24** – Standard NDI Formulation

- High performing material on the market
- BASF formulation for over 30 years

3. **Cellasto® SM72** – NDI/MDI Copolymer

- Uses both NDI and MDI chemistry
- Lower cost than MH24C

4. **Cellasto® L** – MDI based formulation

- Lower cost material option
- BASF formulation for over 10 years

Cellasto® - Innovative Solutions for the Automotive Industry

Our Philosophy: Intelligent Solutions – Implemented as a Team Effort



According to the strategic guideline

“Help our customers to be more successful”,

we develop together with our clients tailor-made and individual solutions. In addition we are increasingly developing new PU applications.

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Thanks for your attention

 **BASF**
The Chemical Company

Our Team is pleased to meet you at our stand !