Damping Vehicle Vibrations

Innovations in Cellasto®

Elastogran is Polyurethanes

Elastogran

- BASF Group
Nine out of ten automotive manufacturers answer “yes” when asked whether they use Cellasto spring aids. Assembled in chassis systems they make driving more safety, more pleasant and more comfortable.
The world is moving with Cellasto

Individual problems require customised solutions. The current Cellasto range comprises more than 1500 products specially designed for the world’s vehicles, but all of the Cellasto elements have one thing in common: they minimise noise, vibration, harshness.

Cellasto – cures the cause, not the effect

Spring aids, top mounts, steel spring isolators, buffers, roll restrictors or, even better, in the form of a complete Cellasto Damping System (CeoDS®) Cellasto absorbs vibration and noise. To improve an atmosphere of well-being in the vehicle Cellasto minimises the unpleasant effect of harsh engine combustion noise, vibrating car bodies as well as rumbling shock absorbers.

Damping elements made of Cellasto are volume-compressible. This feature makes Cellasto ideal for compression tasks in confined areas.

In brief

Cellasto® Cellasto is Elastogran’s registered trademark for microcellular polyurethane elastomers. Its physical properties make Cellasto an optimum material for the use in components that must endure a high dynamic load, e.g. vibrations of all kinds in the vehicle chassis. Cellasto parts are volume-compressible and only show low lateral expansion when compressed. Therefore Cellasto components can be used in small packaging areas where they can provide high flexibility.

Half a century of know-how
1957: Development of the first free-foamed isocyanate polyol-water mixture in open steel moulds.
1958: Replacement of the free foaming process by foaming processes in closed moulds, producing spring elements with uniform cell structures.
1964: Start of serial production with the introduction of automated machines.
Since 1974: Gradual expansion of production plants. The company now has developed into the supplier of most domestic automotive manufacturers.
Since 1983: Expansion of export activities and development of new recipes. Partner of the entire German automotive industry.
1990: The renowned high quality of Elastogran Cellasto spring elements is confirmed by the granting of numerous awards (e.g. the Ford AG’s Q-1 award, Monroe Europe Ltd. „Preferred Supplier“).
Since 1993: Clear intensification of Research and Development activities (shorter development cycles, exploration of new applications).
2000: Cellasto Damping System (CeoDS®): modular system for well-fitting customised links between chassis and vehicle body.

Noise, Vibration, Harshness (NVH) Cellasto components dampen vibrations in a frequency range which is regarded as especially unpleasant by human beings. That is why Cellasto makes passengers feel more comfortable.

Cellasto – simply better

- Cellasto is a sophisticated and well-proven material
- Cellasto saves space due to its compressibility
- Cellasto is economical
- Cellasto has a long service life
- Cellasto is environmentally friendly and recyclable
- Cellasto makes vehicles safer and more comfortable.

Nine out of ten automotive manufacturers decide in favour of Cellasto damping systems
NVH diagnosis: dangerous and exciting

Rumbling, stuttering, jerking, jolting, vibrating, roaring, cluttering, unsafe cornering: the complete range of “exciting” symptoms.

Diagnosis: Insufficient tuning of driving comfort and dynamic driving behaviour which is anything but pleasant for the driver – and for the image of the vehicle manufacturer.

But this is not inevitable...
Experts reduce NVH

It is easy to produce low NVH vehicles if you involve the Elastogran experts from the Cellasto Automotive Components Division based in Lemförde. This division provides NVH experience and expertise gathered through three decades in the development of Cellasto, acting as a partner and co-designer supporting the automotive industry and also through the production of Cellasto components. Roll restrictors, clips and other engine, seat and door components as well as spring aids, spring isolators and top mounts for the suspension form the priorities of our work.

CeoDS operation

The most comprehensive solution to reduce NVH in the chassis is offered by our Cellasto Damping System (CeoDS). The different properties and features...
Green light for Cellasto vibration damping

Provided by several Cellasto components jointly form a complete damping module. Depending on the type of suspension used, CeoDS may consist of spring aids with top mounts and/or steel spring isolators. CeoDS – vibration reduction at its best.

The earlier the better

Leading automotive manufactures involve Elastogran experts right from the start when planning/drafting specifications for a new vehicle. Together as a team we can utilize the full potential of CeoDS. The effect: Simply better results due to a more co-ordinated, more profitable and faster development phase.

Use digital instruments

As a co-designer we establish direct digital data exchange with the automotive industry. The interchange does not only comprise commercial and accounting processes but all relevant areas in design, engineering, simulation, co-ordination, test and release, thus saving time and money. The state-of-the-art software, our Cellasto database and our application technology enables us to present Cellasto developments within a timeframe which, a few years ago, would have been regarded as a utopia.

E-commerce and B2B marketplaces—these are catchwords describing the immediate future of our co-operation. The importance of electronic marketplaces is rising continuously, especially at the business-to-business level. Our participation in the Covisint Internet platform shows how we together with BASF accept the challenges of this development. With our words: We are already prepared for digital business processes.

In brief

Cellasto components
Elastogran develops, produces and distributes Cellasto components for vibration damping (NVH). Elastogran does not only produce suspension elements, top mounts and body mounts, roll restrictors, clips and bump stops as well as seat dampers but also Cellasto spring aids.

Cellasto Damping System (CeoDS)
CeoDS is a complete NVH solution in the chassis, consisting of the individual Cellasto components that complement each other in terms of their features—and thus enable customised synergy effects.

Staff potential
As a co-designer, Elastogran has experienced, highly skilled development engineers from all relevant areas and chemical engineers for material development:
- Central development in Lemförde
- Development of target parameters in close co-operation with the customer
- Highly motivated, well-trained staff in production and sales guarantee smooth operation/workflow.

Technical potentials
Services offered in development and design: acoustic laboratories, FEM, FFT analysers, hydropulsers, shakers, drop testers, simulation software, Cellasto database with more than 1500 different components. Services offered in our production facilities: largely automated production. Flexibility for the various Cellasto material settings with a variety of moulds.

Added value without added cost
Our component development focuses on creating added value for our customers—without producing higher costs. This is achieved by using intelligent products to provide:
- More driving comfort
- More safety / better dynamic driving behaviour
- Better noise reduction
- Less weight
- Fewer parts
- Smaller packaging
- Improved durability
- Higher profitability.

Green light for Cellasto vibration damping
Innovative forces create turbulences, demand changes, are the symbol of dynamic developments – whereas traditional elements provide safety, reliability, balance. All these forces are combined in the joint aim of permanent progress.

What is important, however, is not only making progress as such, but also the question how this progress is achieved

Relaxation, repose, and comfort - these are demands, which are gaining more and more importance in our society. However, these demands very often are in conflict with the dynamic processes.

The task now is to make these extreme positions compatible. It is important to do this in the most efficient way taking into account all natural resources available.

The solution is the combination of homogeneous forces. In this way,
synergies can be used and room for manoeuvre can be created.

It is possible to realise dynamic vehicle behaviour and driving comfort at the same time.

In Cellasto, Elastogran has a material which has been creating driving comfort by damping vibrations in various vehicle applications for years providing for dynamic behaviour at the same time. But we even go a step further. We want to use synergies to create the scope for development you need. This is why we developed the CeoDS Cellasto Damping System.

CeoDS is a compound solution consisting of several Cellasto components and units such as spring aid, top mounts and steel spring isolator. Based on our comprehensive expertise in these areas, Elastogran is in a position to offer complete modular solutions for the customers. CeoDS was designed as a multi-part module solution. A solution consisting of three parts for example integrates the spring aid, spring isolator and top mount functions. This Cellasto combination in one system gives the customer clear synergy effects. The individual, target-orientated co-ordination and adjustment of the individual elements results in a customised damping system accommodating your needs and requirements.

Depending on the suspension system selected, CeoDS also exists as a two-part module providing an adequate vibration damping solution. One variant is the combination of a spring aid and a spring isolator. This usually contains two separate Cellasto elements which are adjusted in the development process. Additionally, the spring aid and the spring isolator can also be foamed into one Cellasto part resulting in the so-called sombrero. Further two-part solutions: combinations of spring aids and top mounts or spring isolators and top mounts. One statement can be made for all these combinations: the production of the complete modular solution optimally uses all potentials and combines the various forces right from the start.

The CeoDS Cellasto Damping System provides a customised link between chassis and body of the vehicle resulting in utmost comfort – in the entire range of vehicles from micro cars to luxurious sedan vehicles.

In brief
CeoDS succeeds in combining several individual stand-alone products into a module.

The benefits:
- Distinct expertise in the areas of spring aid systems, shock absorber / damper mounts and steel spring isolation
- Synergies due to the optimisation of the Cellasto potentials
- Development of a customised compound solution meeting the highest demands for dynamic vehicle behaviour and driving comfort
- Shifting the responsibility for tuning process in the individual modules to us, which means you are saving time and money
- Reducing logistical and organisational efforts (one delivery)
- Protecting the environment and natural resources as the different parts of the Cellasto solution linked mechanically can easily be separated again and recycled.
Cellasto chassis applications: special solutions for each suspension system

All parameters must be taken into account to achieve a successful combination of a comfortable chassis, high-quality safety features and dynamic vehicle behaviour.

Various forces have an impact on safety and dynamic behaviour:
- Vertical forces from suspension and damping
- Longitudinal forces from propulsion and braking
- Transverse forces in curves.

Whether and in how far these forces have a major impact on the vehicle depends on the suspension system used. Thus, the development and design of Cellasto elements must consider the type of suspension system used. The simulation of properties and driving and dynamometer test values help develop a solution that can properly control the forces occurring in the vehicle.

Cellasto spring aids are being used by all automotive manufacturers.

The success of Cellasto spring aid systems is due to:
- Low lateral expansion and therefore low package space requirement
- Low compression set due to static and longtime dynamic loads
- Optimised cell structure for progressive compression stress behaviour.

Additionally, the use of Cellasto also increases profitability. Usually, vehicle suspensions are characterised by progressive curves which means that resistance rises with increasing compression. The use of Cellasto in combination with shock absorbers and a steel spring can now produce an overall progressive spring curve. Thus, it is now possible to use a low-cost linear steel spring (instead of a progressive steel spring with bump stop).
The individual modules:

spring aid – top mount – spring isolation

Top mounts have a major impact on comfort and dynamic driving behaviour. Due to micro decoupling they isolate minor road surface irregularities and also provide strong shock absorber linking to the body on major irregularities and single obstacles. This is possible by using amplitude-selective Cellasto Damping Systems. Low damping values for small amplitudes result in excellent vibration and noise insulation. Higher damping values for longer oscillations result in a targeted, selected dynamic stiffening of the mount which means an optimum link of the shock absorber at macro level.

Spring isolation module

The car suspension – which is usually provided by a steel spring – takes up the static vehicle weight when the vehicle is standing still, and the dynamic loads when the vehicle is moving. A special spring isolator supports the steel coil spring protecting the car body and the passengers from road-surface induced vibrations. The spring isolator must efficiently dampen the spring resonances and simultaneously reduce chassis and road-borne noise in the vehicle body.

Cellasto spring isolators are especially fitted to meet these requirements. They reduce resonance related peak forces and additionally reduce structure borne noise. Furthermore they are abrasion resistant and the low compression set leads to a high fatigue strength.

In brief

McPherson suspension
This is the most popular and wide-spread suspension type, especially for front axles, and describes the classical application of a compact, integrated damping system. Due to the fact that the entire suspension/damping forces as well as additional forces from wheel guidance must be absorbed, the requirements to be met by the damping systems are extremely high. A three-part module solution ensures excellent properties in terms of suspension dynamics, precise steering and driving comfort. The disadvantages regarding the body sensitivities can be compensated for by the CeoDS solution.

Double wishbone suspension / multi-link suspension
This suspension system type makes high demands on the elastokinematic properties. The sensitive analysis of the property profile supported by modern simulation technologies enables us to develop an optimum solution with a well-adjusted CeoDS.

Twist Beam suspension
This suspension concept which is frequently used in the rear axle systems of compact cars, makes high demands from a damper system, especially regarding suspension roughness. Depending on the selected spring concept two- or three-part CeoDS solutions may be applied. Twist Beam suspension

There are a wide variety of suspension systems. And the requirements to be met by the damping system also vary depending on whether you select a semi-trailing link, a trailing link, a conventional hydropneumatic suspension system or an air-spring system. The best link to the car body, however, is the same for all these types: CeoDS.

CeoDS is a sophisticated combination of Cellasto components that have been established on the market as separate vibration-damping solutions for years.

CeoDS offers a lot of room for manoeuvre.
Other Cellasto applications in the chassis

In modern wheel suspension systems, high requirements are specified for the bushing components in the wheel guiding elements. These bushings dampen vibrations and absorb braking and acceleration forces from the wheels.

In a conventional hydro bushing, the rubber end buffer is subjected to high abrasion loads, which might result in a premature failure of the bushing.

The task: Extending the durability of the hydro bushing without changing the part geometry.

The solution: Development of a bump stop (clip) made from highly abrasion resistant Cellasto. The hydro bushing modified with Cellasto passes the most demanding durability tests. The extremely high volume compressibility, the low deformation and progressive LD-curve give the Cellasto bump stopper a soft initiation and a safe travel limitation. This means higher driving comfort and improved safety for the driver.
Cellasto as roll restrictor

In addition to the engine mounts, engines need a roll restrictor, which restricts the rolling movement of the engine in load changing processes.

Additionally, the roll restrictor is meant to protect the car body from harmful vibrations caused by the thrust, traction and idle operation of the engine. These requirements characterise the LD-curve of the roll restrictor: it must be soft around the central load position and reach and maintain a fixed end position for larger movements.

Cellasto is the right material to realise these parameters – from a physical and from an engineering point of view. Cellasto’s cellular structure linked with a suitable design succeeds in catering for both: the soft start when applying the load in the beginning, up to the progressive compression stress behaviour with increased load. For the vehicle’s passengers this means clearly improved vibration behaviour. Cellasto roll restrictors also meet special fatigue strength requirements: they easily survive high ambient temperatures as well as exceptionally high loads in the case of misuse.

Cellasto as a body mount

The elastic decoupling of frame and body for example in a four-wheel-drive vehicle provides improved driving comfort because the noise in the passenger compartment and the occurring vibrations are reduced. It is especially important to avoid excitation in the seat frequency area.

The task: a perfect body mount must be soft in the static load point; however, it should limit maximum compression and provide high dampening at high amplitudes.

The solution: the use of Cellasto as a body mount makes it possible to reduce the noise in the vehicle interior and provides a clearly improved vibration dampening. A comparison with conventional material shows a clear difference.

In brief

There are numerous other applications which are ideal for Cellasto. Some examples:

- Stick shift knob damper
- Seat damper
- Run flat tyre
- Bump stop
- Subframe bushing
- ...
Future innovations

Multi-body simulation. What is the impact of a predefined road profile on the individual components/parts/elements of a front axle? Multi-body simulation gives us the possibility to modify each suspension detail as required.
Cellasto is well known for its sophisticated problem solutions to reduce noise, vibration and harshness. We use the most modern calculation and simulation techniques, which enable us to implement requests and current requirements in line with what our customers wish. But Cellasto is more than that.

**Cellasto means innovation**

The future of the automotive industry is clearly outlined. Virtual development methods gain more and more importance. Simulation models reflect reality – lengthy practical test series will no longer be required. But it is important to have the right partners who can implement complex requirement profiles in a way that is compatible with the system.

Cellasto will accompany you on your way. We design optimised simulation models creating the requested property profiles on the basis of the specifications defined by the customer. Following the black box principle, we want to transform your technical ideas into a service package that meets your requirements. Having checked the geometric frame conditions, we will simulate the desired comfort properties and even crash situations.

**In brief**

**FEA**
The Finite Element Analysis (FEA) is a numerical process to calculate mechanical properties. Based on a comprehensive expertise on material laws, the physical behaviour of Cellasto components is simulated. Critical influences are recognised and avoided right from the start, functionality and durability can be improved.

**Multi-body simulation**
Multi-body simulation calculates the dynamic behaviour of complex systems taking into account the specific mechanical properties. Based on the property profiles, the influence of CeoDS on driving comfort and driving properties is simulated to provide a target-oriented adjustment of the system.

**Our innovation – your benefit**

- Use of compatible complete solutions
- Reduced costs
- Shorter development cycles
- Simplified development processes
- Integration of the latest technologies.
Elastogran is polyurethanes

Industry leader

The Elastogran Group is one of the worldwide leaders in polyurethanes (PU). As part of the BASF Group, we have over 40 years’ experience in the PU industry. Our head office at Lemförde, Lower Saxony, hosts the Technology Centre for BASF polyurethanes worldwide. Elastogran is the market and technology leader for polyurethane systems and polyurethane special elastomers, as well as the leading supplier of polyurethane basic products.

Cooperating closely with the customer

The Elastogran Group has one site in Germany and eight European companies with nine locations. We distribute all PU basic products of BASF throughout Europe, while developing, producing and distributing polyurethane systems, thermoplastic and cellular special elastomers.

All the PU business of BASF in Europe, the Near East and in Africa is dealt with by Elastogran. Here we have achieved through cooperation. Elastogran agents and BASF distribution companies operate around the globe in close partnership with their customers.

Customised innovation

Whatever the PU application, Elastogran turns the seemingly impossible into innovative reality. Our specialist teams of chemists, physicists, engineers and sales personnel develop customised, creative and economic solutions to problems through joint project work with our customers. Active dialogue and exchanges of experience are the reliable basis of cooperation. A pan-European sector-specific applications engineering service concentrates consistently on potential benefits.

Integration

The close link with BASF, one of the leading chemical companies in the world, allows us access to the worldwide BASF resources: in research, raw material supply, infrastructure, sales and marketing, and finance.
Acting responsibly

Responsible Care®

Elastogran supports the global initiative Responsible Care, which is devoted to ensuring the chemicals industry acts responsibly. We therefore undertake to make continual improvements in the fields of safety, health and environmental protection.

To Elastogran, responsible policies in these areas are as important as a company's commercial success. The whole process of development, production and storage of our products, as well as their transportation, application and disposal or recycling, is therefore regularly assessed in relation to reduction of possible impact on the environment, and further developed on a continuous basis. In particular, this includes the preservation of resources and avoidance of emissions and waste.

Always, we keep our clients, partners and neighbours informed of the environmental aspects of products and processes. Our environmental-management system is based on the Responsible Care guidelines and fulfils the requirements of the international standard ISO 14001.

Recycling PU

The methods of reusing polyurethane are as diverse as its uses. To determine the appropriate method, it's important to clarify the origin and use of the polyurethane to be recycled. As well as thermally reusing PU products, we also aim to recycle production waste where possible.

In practice, the following procedures are used:
- flock bond
- particle bond
- chemical recycling
- raw material processes

Generally, it's not possible to say whether such procedures are more ecologically beneficial than thermally reusing products.

Quality management

Client satisfaction is the basis of enduring commercial success, and we strive to meet our clients’ expectations of our products and services.

In order to guarantee this, a quality management system was introduced at Elastogran several years ago, extending to all areas of the company. Every business process is regularly assessed using key performance indicators, and is further developed as a result. The aim is to optimise the efficiency and make the relationship between all activities and processes as smooth as possible. Every staff member is urged to contribute ideas and advice to ensure we are constantly improving our processes.

The basis of Elastogran’s quality management system is the international standard ISO 9001, supported by the supplementary automobile industry requirements ISO/TS 16949.
Elastogran is polyurethanes

The Elastogran GmbH is one of the world leaders for polyurethane (PU) solutions.

The dynamic market and technology leader is a company of the BASF group of companies and has more than 40 years experience with PU. Innovative and profitable customised solutions are developed in close co-operation with our customers to perfectly meet any market requirement. Additionally, the company provides extensive customer service, consistent benefit orientation and highest quality levels.

Elastogran’s high-quality product range includes:
- PU base products
- PU systeme
- PU special elastomers.

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