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Cellasto®
The NVH Solution

Cellasto®

Technical Information

Properties

Quasi-static progressive stress-strain behavior

Cellasto® components are made of a microcellular polyurethane elastomer. It is processed in closed tools using a special foaming process to produce molded parts. Depending on the mass of the material used, the raw density of the molded parts is 350–650 kg/m³. Their pore volume is 50 % to 70 % of the volume of the molded part.

It is possible to supply semi-finished products of lower density levels, starting at 270 kg/m³. The values from measurements of material samples (see diagrams) should be understood as a guide. They are influenced by the installation conditions and form factors, among other things.

The pore diameter is in the range of tenths of a millimeter, and the pores are largely closed. Under compressive loads, the pore volume is compressed first, and then the material itself. It thus becomes more rigid as the deformation increases. The material exhibits progressive stress-strain behavior.

The maximum deformation of Cellasto® molded parts depends on their raw density. With decreasing raw density, the achievable deflection distance increases up to over 80 % of the initial length of the molded part. Molded parts made of our material are characterized by long deflection distances and low block dimensions.

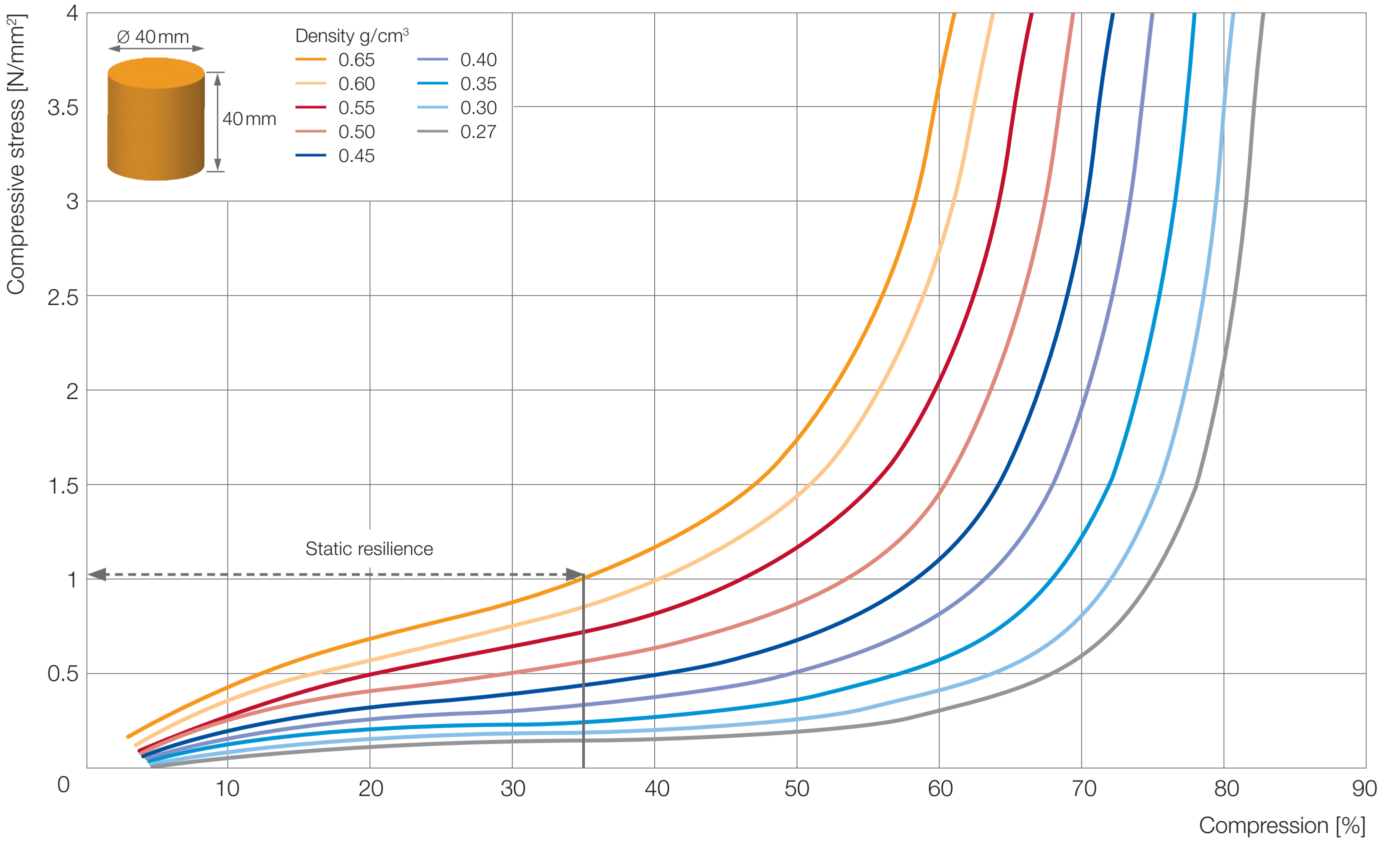


Fig. 1: △ Quasi-static progressive stress-strain behavior

High load capacity, extremely low residual compression set, high ageing resistance, and very good abrasion resistance

A compressive stress of 4 N/mm² is the load limit for Cellasto® components under long-term dynamic load (depending on frequency). But individual impacts that cause stresses of up to 20 N/mm² and more will not destroy the material. The long-term static load is achieved at about 35 % compression of the original height, which corresponds to compressive stresses of about 0.1 to 1 N/mm², depending on the density.

After static and dynamic loading, the extremely low residual compression set can be considered negligible for most applications, even after several years. The desired rigidity of the material remains largely intact.

High ageing resistance and production without plasticizers ensure consistent properties. Good resistance to environmental influences (e. g., temperature, grease, etc.) and very good abrasion resistance support a broad spectrum of applications.

Minimal lateral expansion, high volume compressibility, low weight

Compact elastomers have high lateral expansion when compressed. Cellular polyurethane elastomers, on the other hand, have minimal lateral expansion. Cellasto® spring elements can therefore be used in spring applications with limited installation space. Another advantage of Cellasto® components: their low weight.

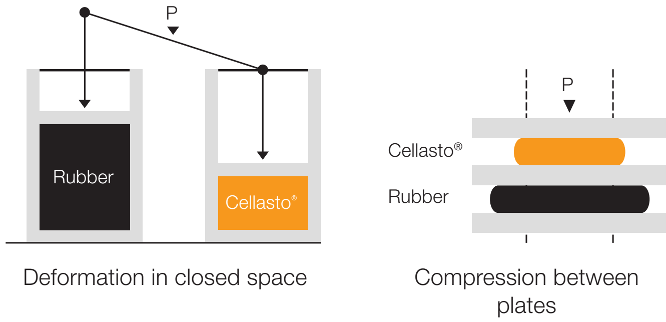


Fig. 2: High volume compressibility with minimal lateral expansion

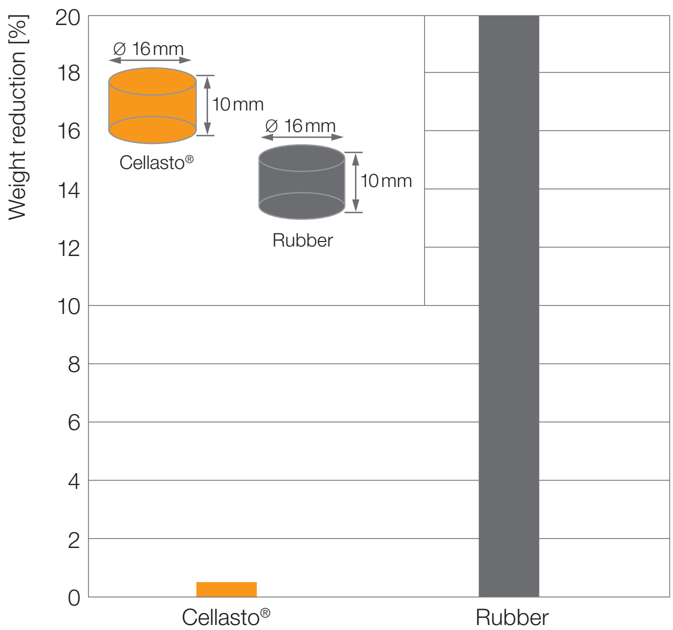


Fig. 3: Abrasion comparison Cellasto® – rubber

Properties

Characteristic curves as a function of the temperature

The mechanical properties of Cellasto® components are dependent on temperature and subject to temperature limits. As temperatures drop, Cellasto® components become harder, so that they can be used down to about –30 °C. Components that are flexible in the cold, with an expanded range of applications to about –40 °C, can be made using a special Cellasto® recipe.

As the temperature rises, Cellasto® components become softer, and the characteristic curve changes only slightly up to about 80 °C. Up to this material temperature, the components can therefore be used without significant changes in spring behavior.

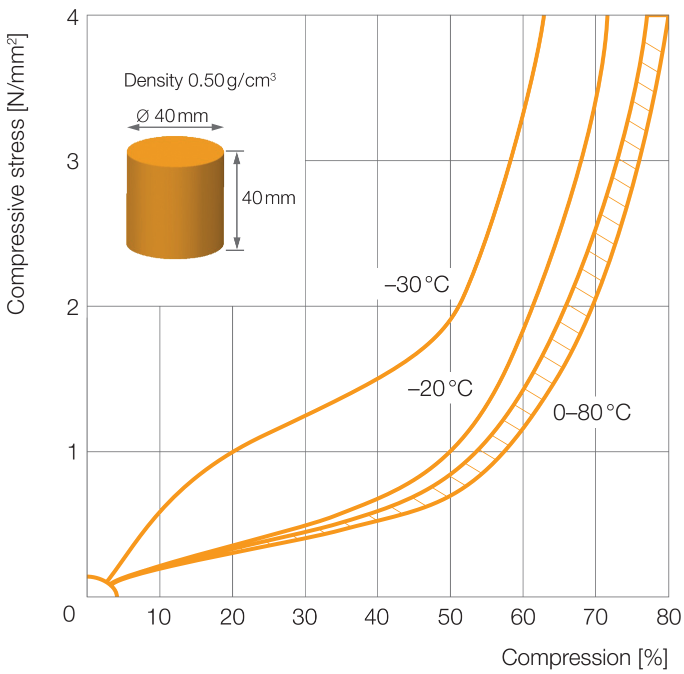


Fig. 4: △ Characteristic curves as a function of the temperature

Increased temperature with damping

The material absorbs part of the applied energy and converts it into heat. Under constant loading, the temperature of the component reaches a point that should not exceed 100 °C over the long term. Brief peaks of higher temperatures are not a problem for the material.
The Cellasto® component that hardens at lower temperatures regains its usual spring properties after just a few load cycles as it absorbs energy under mechanical load.

Material and frictional damping

In many applications, vibrations are undesirable because they lead to shocks that can degrade the functionality of machinery and devices and/or can cause noise pollution of the environment as audible vibrations. This results in the requirement—as vibrations in general cannot be avoided—to reduce the effects to a minimum.

Based on its mechanical properties, microcellular Cellasto® is an excellent material for vibration damping.

When Cellasto® components are compressed, this results in deformation work, which is released in a somewhat reduced form upon relaxation. The work of deformation is represented by the area under the characteristic curve of the spring.

Cellasto® material damping prevents the component from recovering and is evident as a hysteresis loop. Part of the deformation work is thereby converted into heat due to internal friction and is absorbed (as work deficiency).

The ratio of this absorbed portion to the deformation work applied is shown in Fig. 5 and is approximately between 10 % and 20 % (static). This absorbed portion is thus relatively low for Cellasto® (low damping) and is one of the reasons for its extreme fatigue strength.

However, developers have the ability to individually adjust the damping of Cellasto®. Increased damping can be achieved with friction between the wear-resistant Cellasto® material and adjacent components. Absorption rates of over 80 % can be attained in that case. [Fig. 7]

This makes Cellasto® a versatile material for vibration engineering. Its low material damping makes it an excellent option for acoustic insulation, while it is capable of dissipating great amounts of vibration energy through friction damping.

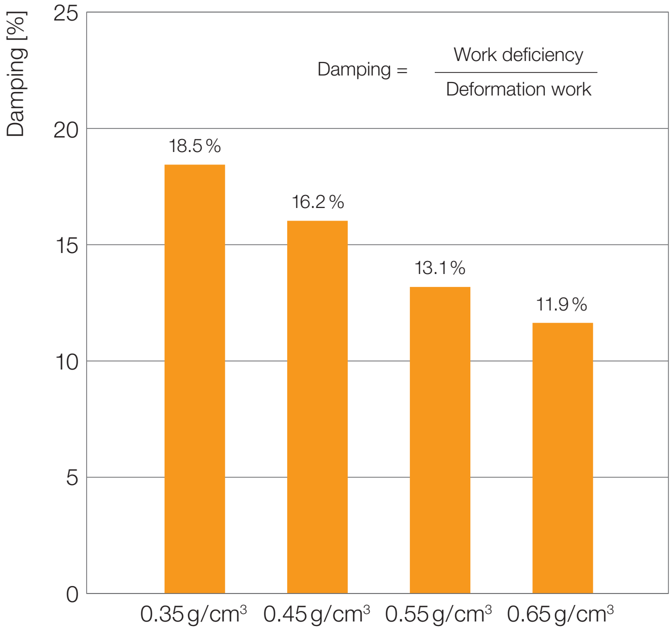


Fig. 5: Cellasto® static damping

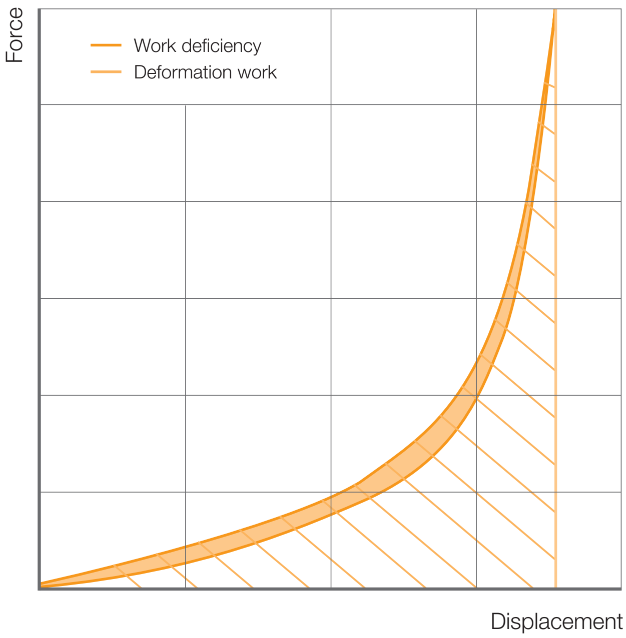


Fig. 6: Hysteresis under compressive load/total energy absorbed (deformation work)

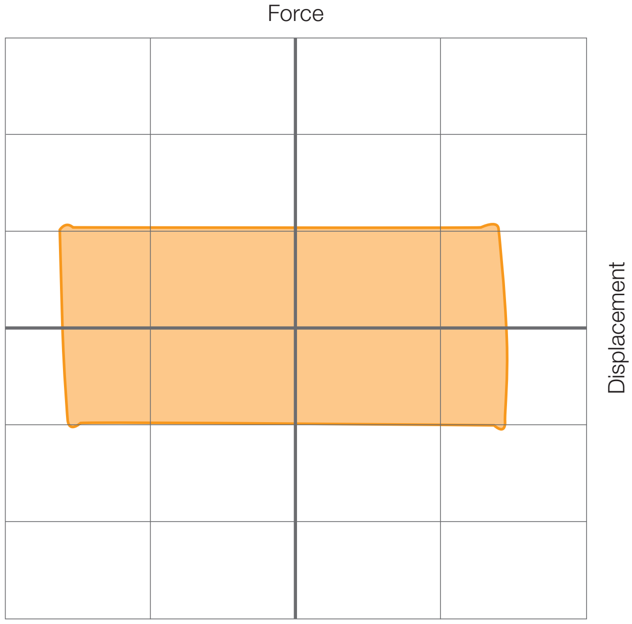


Fig. 7: Hysteresis of a friction damper

Properties

Amplitude-dependent damping

For many applications in the field of vibration engineering, minimal damping at low amplitudes and high frequencies is required for better acoustic insulation. Conversely, larger mass motions, as can occur with resonance or starting and run-up peaks, should be damped out as quickly as possible. These apparently contradictory requirements are met equally well by Cellasto®.

The graph shows the sharp rise in the loss angle, a measure of damping, as the amplitude rises for all material densities.

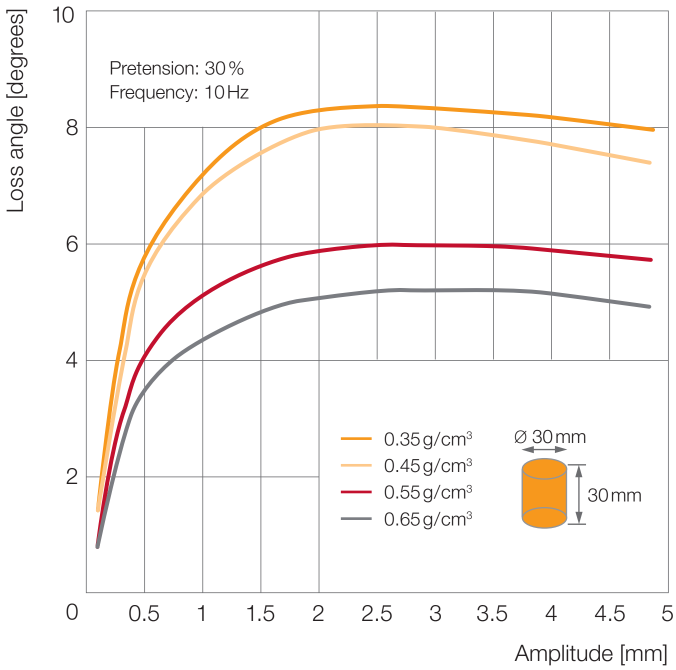
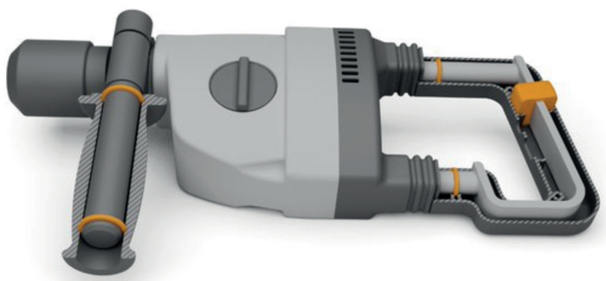


Fig. 8: △ Amplitude-dependent damping



Low natural frequency for small components

The high allowable static spring rates lead to low natural frequencies. The greater the difference between the natural frequency of the insulation material and the frequency of the excitation source (frequency ratio), the more effective the insulation (augmentation function).

The area under load can often be reduced to attain the desired statically permissible deflection rate. In combination with higher deflection rates, Cellasto® components can therefore be very small in size (up to 50 % less volume than rubber elements).

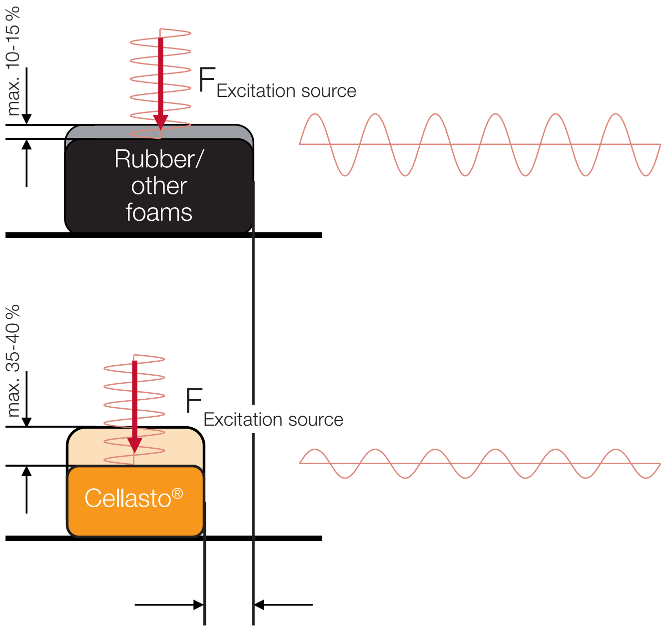


Fig. 9: Size and insulation ratios for Cellasto® and rubber

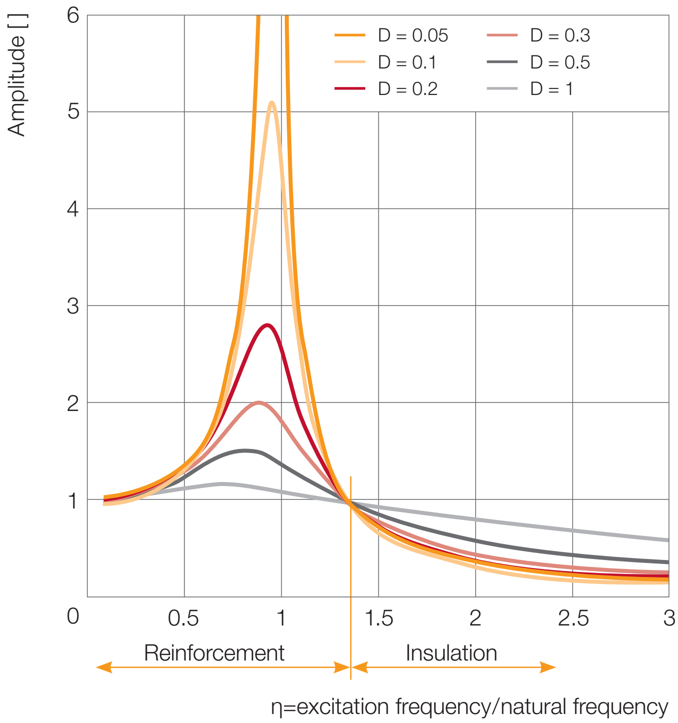
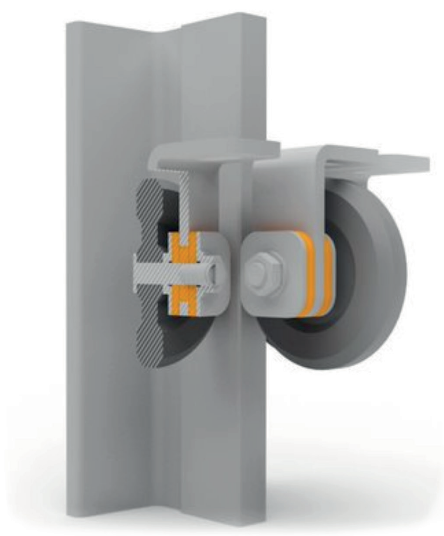


Fig. 10: Augmentation function



Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (January 2022)

We look forward to hearing from you.

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