Fachverband Schaumkunststoffe und Polyurethane e.V.

PUR Cold Foam

Technical Specialist Group PUR Flexible Foam

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Introductory remarks

Within the foam families, there is a wide range of variants of PUR flexible foams, which can be optimally used for certain functions and applications with regard to their respective properties. PUR cold foam has developed as a further quality term for high-quality, resilient, comfort applications.

The following description is intended to define the term cold foam more precisely by distinguishing it from standard PUR flexible foam in terms of both the raw materials used and the properties that characterise it.

The information in the product description PUR flexible foam as well as the material data sheet of the Technical Specialist Group PUR Flexible Foam also apply in full to PUR cold foam.

The term cold foam

The term cold foam, which is used synonymously with highly elastic foam or (High Resilient) HR foam, originally developed from the moulded foam area. By using highly reactive polyols, the temperature of the moulds required for the foaming process could be significantly reduced. This made it possible to foam even in unheated moulds. The term cold foam therefore contains a clear correlation between the quality of the raw materials used and the manufacturing technology.

Chemical characterisation

The raw materials for PUR based on mineral oil are reacted with the use of certain additives. This produces the gas carbon dioxide, which causes the mixture to foam. The individual formulation determines the properties of the finished foam – each quality has its own composition.

From a chemical point of view, PUR cold foam as well as standard PUR flexible foam is made from diisocyanate and polyalcohols in an exothermic polyaddition reaction using catalysts, stabilizers and auxiliaries.

Only special, higher molecular, highly reactive polyether polyols can be used for the production of cold foam. These polyols are characterised in that the primary hydroxyl groups (OH groups) are predominant. Due to the high proportion of reactive primary OH groups, only amorphous or dissolved carbonic acid diamide (urea) is formed during the reaction. In contrast, standard PUR foams mainly contain crystalline urea.

Due to the different morphology of the PUR cold foam compared to standard PUR foams; it can be clearly identified using IR spectroscopy.

Characteristic properties

PUR cold foam can be distinguished from PUR standard foams in terms of pore structure and hardness distribution, air permeability, resilience and comfort properties.

1. Pore structure and hardness distribution

In combination with special additives, a foam with initially closed pores and an irregular structure is produced. Due to the high reactivity, the chemical reaction takes place quickly and a homogeneous hardness distribution is achieved in the slabstock foam. The result is a particularly elastic polymer matrix, which, in conjunction with the irregular pore structure, ensures the high elasticity of PUR cold foam.

2. Air permeability

To increase the comfort properties, the membranes of the closed pores must be broken open after the foaming process. This takes place in an additional further processing step, the socalled crushing. The resulting very open pore structure leads to a high air permeability and thus promotes moisture transport within the material. This property provides a pleasant climate for upholstery and mattresses and considerably reduces the risk of heat accumulation.

3. Resilience

High resilience is the outstanding feature of PUR cold foam. The elasticity can be measured as rebound resilience according to DIN EN ISO 8307. In this process, a standardized steel ball falls onto the foam test piece from a defined initial height and bounces back. The rebound height is measured and expressed as a percentage of the initial height. For mattresses, this is often also indicated as point elasticity. The rebound or point elasticity of PUR cold foam is at least 50% depending on the density.

4. Comfort features

Another feature describing the special properties of PUR cold foam is the comfort or SAG factor according to DIN EN ISO 2439, which indicates the ratio of the compressive stress at 65% compression to the compressive stress at 25% compression. The higher the SAG factor, the better the comfort of the foam, as the material is soft on the surface but provides greater support as compression increases. PUR cold foams reach a value of at least 2.5.

A further measure of the elastic damping and thus the comfort properties of foams is the hysteresis loop when determining the compressive stress properties. It results from the different compressive stress curves during loading and unloading of the material. The difference is expressed as a percentage. The lower this percentage value, the better the comfort value. Cold foams usually reach values between 15 and 20 %.

Fields of application

Due to its pronounced comfort properties, PUR cold foam is particularly suitable for manufacturing mattresses and high-quality upholstered furniture as well as for use in car seats.

Many of the advantageous mechanical properties, however, also depend on the density of the material, in particular the preservation of these properties over the entire product life. The bulk density of high-quality mattress cores and seat cushions should therefore not fall below a limit of approx. 40 kg /m³. The characteristic properties of PUR cold foam, especially its high resilience, have a special effect from a material thickness of 12 cm. This material thick-ness should therefore not be undercut.

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