PMI foams with improved mechanical properties, in particular with increased elongation at tear

Field of the invention

The invention relates to compositions for producing polymethacrylimide foams (PMI foams) with particularly good mechanical properties, in particular with particularly advantageous tensile strain at break. The invention further relates to processes for production thereof, processing and use of the said foams. The invention in particular relates to novel materials which have markedly reduced tendency toward cracking when comparison is made with the prior art. This is equivalent to higher tensile strain at break when comparison is made with the prior art.

Prior art

PMI foams, e.g. ROHACELL® from Evonik Röhm, are used as structural foam in composites and to this end are processed together with outer layers composed of fibres, mostly carbon fibres or glass fibres, and resins. The composites are often constructed at temperatures of 180°C, while the component is also intended for use at temperatures of -55°C. The different coefficients of thermal expansion (CTEs) of the outer layer and of the PMI foams produce cracks in the core on cooling, and this is a criterion that excludes the use of PMI foams in components of this type. The materials usually fail corresponding airline industry tests. There is therefore a high level of interest in foam materials with improved tensile strain at break, not only

strength, at the same time they exhibit a slightly reduced level of thermomechanical properties.

Summary

In a first aspect of the present disclosure, there is provided a process for producing foamable crosslinked polymers, characterized in that the polymer comprises (meth)acrylic acid, (meth)acrylonitrile and a (meth)acrylic diester of a diol, wherein the diol has a molar mass of at least 250 g/mol.

In a second aspect of the present disclosure, there is provided a poly(meth)acrylimide foam, characterized in that it is obtained by foaming of the polymers produced by the process as defined above.

In a third aspect of the present disclosure, there is provided a laminate comprising a layer of a poly(meth)acrylimide foam as defined above.

In a fourth aspect of the present disclosure, there is provided a tube, loudspeaker, antenna, X-ray table, machine part, motor vehicle, rail vehicle, watercraft, aircraft, spacecraft, characterized in that it is composed to some extent of a poly(meth)acrylimide foam as defined above.

Object

It was therefore an object of the present invention to find formulations for the production of PMI foams with particularly high ultimate tensile strength. The foams are moreover intended to have equally good or even improved

thermomechanical properties, when comparison is made with the known PMI foams.

A particular object was to provide PMI foams with tensile strain at break values greater than 6.0%, very particularly greater than 9.0%.

Another object of the present invention was to provide PMI foams with reduced cracking. The said reduced cracking is to be ensured especially in the temperature range from -60°C to 200°C.

Achievement of objects

The objects are achieved via a novel process for producing foamable crosslinked polymers, in particular of PMI foams, where the polymer comprises (meth)acrylic acid, (meth)acrylonitrile and a (meth)acrylic diester of a diol which has a molar mass of at least 250 g/mol.

In particular, the mixture for producing the polymer in the process according to the invention is composed at least of