



1 *Aluminum foam elements:
Adhesive coated (middle) and
filled structure.(right).*

METAL FOAM SPHERES FILLING MATERIAL FOR HOLLOW STRUCTURES

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

Shaping and Functional Materials

Prof. Dr.-Ing. Matthias Busse
Wiener Strasse 12
28359 Bremen | Germany

Contact

Dipl.-Phys. Joachim Baumeister
Phone +49 421 2246-181
Fax +49 421 2246-300
joachim.baumeister@ifam.fraunhofer.de

Dr.-Ing. Jörg Weise
Phone +49 421 2246-125
Fax +49 421 2246-300
joerg.weise@ifam.fraunhofer.de

www.ifam.fraunhofer.de

© Fraunhofer IFAM

Concept

At Fraunhofer IFAM an advanced process route of the well established powder-metallurgical process for the production of foamed metals (FOAMINAL®) has been developed and patented. In contrast to the FOAMINAL® process (near net shape foam parts) the general concept of the foam sphere technology is the separation of two main process steps:

- Foam expansion
- Foam part shaping

Metal foam parts can be produced using small volume metallic foam elements which are expanded in bulk/mass production. Joined to each other in a separate process step the foam elements form the metal foam part.

Characteristics

- Pore morphology/mechanical properties adjustable independent of part's geometry and volume
- Max. volume of largest pore for complete part volume guaranteed
- Homogeneous, multi-phase and/or local gradient pore structures possible
- Mono-, bi- or multimodal combinations/mixtures of foam elements with different properties (densities, geometry, matrix material) possible
- Integral foam part density (0.3 to 1.0 g/ccm for Al alloys) defined adjustable
- Surface structure of foam parts is determined by the geometry of the single elements and the employed joining process.



2



3



4

Foam properties and application areas

Fraunhofer IFAM continuously further develops the foam sphere technology. Current results show that foam sphere parts have similar/partly improved properties compared to FOAMINAL® parts (with similar density). A detailed compilation of property data is available on request. Application areas for these foam parts are:

- Energy absorbing structures
- Stiffening elements for thin-walled shell structures
- Sandwich structures with foam element core layer
- Vibration attenuation
- Packaging
- Melt covers (metal melts)

Foam elements (standard)

- Material: AlSi 10
- Density: 0.5 to 1.0 g/cm³
- Diameter: 1 to 15 mm
- Shape: nearly spherical

Other shapes are available on request.

Foam parts

With the foam sphere technology pure foam parts as well as foam filled hollow parts can be produced in three process steps:

1. Supply of e. g. adhesive coated foam sphere elements by Fraunhofer IFAM (fig. 1, middle)
2. Pouring of the foam elements into a mould or a hollow structure to be foam filled.
3. Activation/Curing of adhesive coating by heat treatment, e. g. 180 °C for 30 min. (fig.1, right).

Currently Fraunhofer IFAM can offer several adhesive coatings that are non-tacky at RT and thermally stable up to 110 °C after curing. Further cold-curing adhesive systems for joining the single foam elements are under development.

Hybrid foams

If the adhesive coating contains a foaming agent the adhesive will first foam up during the final heat treatment and then cure, resulting in a hybrid foam structure where the aluminium foam elements are embedded into a polymer foam matrix.

Sandwich structures

Metal foam elements can also be employed as core layer for lightweight sandwich structures (fig. 3). The e. g. adhesive coated foam elements are placed between the surface sheets. In a hot press the adhesive is activated and cured for joining all layers to form the sandwich structure. Adhesive and face sheets (material and thickness) can be selected according to the desired application.

Serial production and costs

Due to the bulk character the whole process chain can be fully automated. Since the foaming process and the molds are significantly simplified, a competitive material price has been estimated for large scale serial production.

Our offer

- Feasibility studies and foam part development
- Supply of standard foam elements (as produced or adhesive coated)
- Production of specifically customised foam elements and foam parts
- Training courses, workshops and technology demonstrations
- Licensing and technology transfer of the patented metal foam technology

2 *Metal foam elements.*

3 *Sandwich structures.*

4 *APM-Hybridschäume.*