



- 1 Extruded profile made from a polymer metal composite.
- 2 Aluminium composite sandwich with sensory properties.
- 3 Soft and elastic composite material, as flexible as rubber and as conductive as metal.
- 4 Thermally conductive polymer composite tubes.

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

Shaping and Functional Materials

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ELECTRICALLY AND THERMALLY CONDUCTIVE POLYMER COMPOSITES

Polymer composites combine the positive properties of plastics, metals and/or ceramic materials and open up new fields of application for the user thanks to the resulting high-performance material. These composites distinguish themselves from other composite variants available on the market with their very high achievable degree of aggregate filling of up to 50 % v/v. The composite unites the good resistance to chemicals, low weight and easy processing of polymers with, for example, the good electrical and thermal conductivity of the metals. Despite the high degree of filling, the material can be processed under more or less consistently good processing conditions on the normal machines and plants employed in the plastics industry.

The process

The material is produced in a special compounding process which takes into consideration the later application or load scenario of the composite from the outset. The percentages by volume of the individual material components can be varied here in exactly the same way as the type of these individual materials. Besides an array of thermoplastic polymers such as Pa 6, Pa 6.6, Pa 12, PP, PPS, ABS, etc., thermoplastic elastomers can also be used as matrix polymers. Solid and molten metallic substances as well as ceramic powders can be mixed into the plastic melt as additives. Here again there is a choice of different materials.



3



4

Applications

The composite material can be injection moulded or extruded and, depending on the choice of matrix polymer, can also be machined. Furthermore, it can be highly compacted through pressing, and processed to form a thin laminable intermediate through rolling and calendering. Applications for the composite material can be found, for example, in functionalized assemblies where electrical or thermal conductivity is to be implemented through an integrative process, such as two-component injection moulding or co-extrusion. As a full-surface application in cable sheaths or housings, comparable shield attenuation (80 – 90 dB at 300 kHz – 1.2 GHz) can be achieved, as with metallic materials.

Composite with sensory properties

Apart from the described applications of the composite as an electrically or thermally conductive plastic, the material is also very suitable for use as an intrinsic sensory material. Depending on the type of matrix polymer used and the degree of filling, the sensory properties of the composite can be oriented to detect tensile or compressive loads and thus used, for example, for the structural health monitoring (SHM) of components.

Our offer

Polymer composites offer a high degree of potential for the integrative functionalization of components, combined with cost-effective and efficient processability.

The Fraunhofer IFAM offers you the following services in this field:

- Composite formulations tailored to the customer's wishes for the specific application
- Material sampling and optimization through to series production
- Material tests and characterizations of the physical, chemical and mechanical properties of the formulated composite
- Analysis of reliability, aging and climatic behavior of the material
- Testing of processing methods such as injection moulding, extrusion, rolling, etc.
- Market analyses and feasibility studies for functional composites
- Process integration, profitability studies and know-how transfer

