PRESS RELEASE

HoverLIGHT: Fraunhofer Researchers Develop Unique Damping for Machine Tools

Fraunhofer Institutes for Machine Tools and Forming Technology IWU and for Manufacturing Technology and Advanced Materials Research IFAM have made a breakthrough in materials research. The composite material HoverLIGHT sets new standards for the construction of machine tools: by combining aluminum foam and particle-filled hollow spheres, HoverLIGHT achieves an unprecedented combination of lightness, stiffness, and vibration damping. In a joint project with an industrial partner, the two Fraunhofer Institutes have demonstrated for the first time that HoverLIGHT can dampen vibrations in series machines by a factor of 3. All this comes with a weight saving of 20% compared to the original assembly.

Lighter, More Precise – The Advantages of HoverLIGHT

HoverLIGHT is a composite of metal foam and hollow spheres and can serve as the core of sandwich structures. This sandwich principle results in a significant weight reduction, and the HoverLIGHT core guarantees high damping: the aluminum foam with the integrated hollow spheres dampens vibrations significantly more than previously used composite materials, leading to higher precision in machining and a longer lifetime of the machine. The sandwich construction also enables significant weight savings, allowing for higher dynamics in machining processes. HoverLIGHT adapts to the specific requirements of different applications.

Successful Application in Practice

In a joint project with Chiron Group SE, HoverLIGHT has been working effectively in the crossbeam of a milling machine. The results are impressive:

- 20% weight reduction: The HoverLIGHT crossbeam is significantly lighter than a comparable assembly made of conventional materials.
- Significantly higher damping: Vibration damping increases by a factor of 3, leading to higher precision and longer tool life.
- Increased productivity thanks to higher speed and precision: Machines can produce more parts in less time when equipped with HoverLIGHT crossbeams.

Dr.-Ing. Jörg Hohlfeld, responsible for the research area of metal foam at Fraunhofer IWU: "With HoverLIGHT, we have developed a material that pushes the boundaries of

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what is possible in vibration damping. We solve the conflict of objectives that arises from the inherently contradictory requirements of a stiff design of modern machine tools, lightweight moving assemblies, and effective vibration damping."
All moving components in machine tools, such as machine slides, are predestined for HoverLIGHT. However, numerous other applications are also conceivable outside mechanical engineering, wherever lightness, stiffness, and precision matter.

- Robot arms designed as sandwich structures would benefit from high stiffness at low mass, as lower weight allows for higher speeds and accelerations.
- Stiffening structures made of aluminum foam are already part of crash structures in series production cars, albeit without particle-filled hollow spheres, whose primary task is to reduce vibrations. Foam structures are sufficient for energy absorption.
- Wall and floor elements for rail vehicles are suitable for the use of HoverLIGHT; in the Beijing subway, the floor plates consist of sandwiches with an aluminum foam core - for better damping at lower weight.
- In servers and high-performance computers, lightweight and stiff housings are necessary to ensure stability and heat dissipation while damping vibrations.
- Medical applications such as MRI or ultrasound devices rely on lightweight and stiff designs; only in this way can precise measurements be guaranteed and vibrations that impair image quality minimized.

The Next Goal: Attractive Manufacturing Costs

The researchers are continuously working to improve HoverLIGHT and expand its range of applications. The goal is to adapt the properties of the composite material to the requirements of further applications and to reduce its manufacturing costs through industrialized processes. The production of hollow spheres is complex, energy-intensive, and not yet reproducible. A promising approach is to use simpler and thus cheaper to produce metallic blisters instead of hollow spheres, as in drug packaging. The Fraunhofer team is confident this should allow for significant cost reductions within a few years.

Fig. 1 The composite material HoverLIGHT has a core made of aluminum foam with encapsulated hollow spheres (visible in the cross-section as round openings). The combined damping effects of foam and particle-filled hollow spheres are comparable to those of magnesium.
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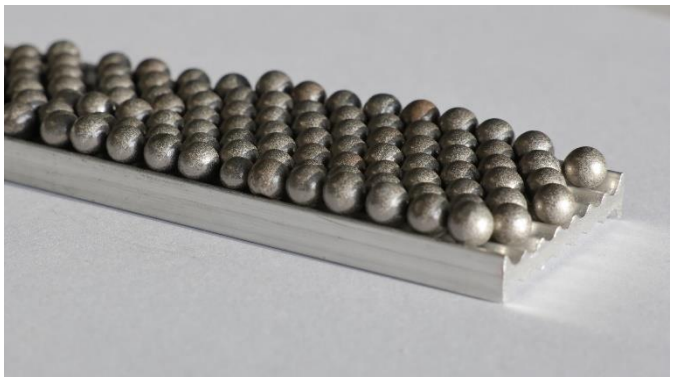

Fig. 2 Particle-filled hollow spheres on foamable aluminum.
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Fig. 3 Sticks: The drum peel test (DIN 53 295) proves that the cover sheets and sandwich core form a stable bond.
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