

Citrus fruit inspires a new energy-absorbing metal structure

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It has been said that nature provides us with everything that we need. A new study appearing in Springer's *Journal of Materials Science* may lend credence to that claim. Researchers from the Foundry Institute of the RWTH Aachen University in Germany, and Plant Biomechanics Group of the University of Freiburg, Germany, have developed an aluminum hybrid that could be used to optimize technical components and safety materials. And the inspiration came from an unexpected source – the peel of the pomelo fruit (*Citrus maxima*).

Pomelo fruits have a mass of one to two kilograms, but are able to withstand impact forces resulting from falls of over 10 meters. The fruit's impact resistance is mainly due to the hierarchical structuring of the peel, which is made up of a graded, fiber-reinforced foam. The new aluminum hybrid is the product of a bio-inspired approach, combining metals with different mechanical properties that reflect these naturally occurring structures and mimic the strength of the pomelo peel.

To make use of the pomelo's ability to absorb impact energy, the "block mold casting" process

was modified, and the pomelo foam's strut composition was transferred to a metal hybrid. This hybrid consists of highly ductile pure aluminum in the center and a high strength aluminum-silicon alloy in the outer shell.

The composite exhibits a much higher tensile strength (the force needed to break something apart) than pure aluminum, and a much higher ductility (the ability to withstand permanent changes in shape) than the aluminum-silicon alloy. This new combination of materials exhibits a novel behavior under load, and the authors suggest safety materials as the best and most obvious use for the new bio-inspired composite material they've created.

"The demands of designers and consumers on forthcoming components will be increased in the future," said Sebastian F. Fischer of RWTH Aachen University, lead author of the study. "The main reason for this is the need for energy-saving, light-weight products, especially in the automotive industry. These challenges can be met by enhanced material properties or composites. And while the development of new materials is increasingly difficult, the joining of different [materials](#) with different properties holds a lot of promise."

More information: Fischer, S.F. et al (2013). Production and properties of a precision-cast bio-inspired composite. *Journal of Materials Science*. DOI: [10.1007/s10853-013-7878-4](https://doi.org/10.1007/s10853-013-7878-4)

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