Press release

Hanau, February 1, 2018

Heraeus secures usage rights to new, amorphous metal alloys containing sulfur

Successful cooperation with Saarland University opens up lightweight applications in the aerospace industry with a new class of amorphous metals

Researchers at Saarland University have, with support from Heraeus, developed a new class of amorphous metals. The very light titanium-sulfur alloys are almost twice as strong as conventional titanium-based metals and are excellently suited for lightweight components in the aerospace industry. There, every gram of weight saved makes a difference, and the stability and strength of the material are crucial. The Amorphous Metals startup of the technology group Heraeus provided financial and logistical support to the scientific work of researchers at the university's Chair for Metallic Materials. The global family-owned business has secured the usage rights for most of the new alloys (patent pending).

With the founding of the Amorphous Metals start-up, Heraeus is expanding its expertise in the processing of and applications for this fascinating class of materials. "The market is clamoring for new materials with new material properties. We can melt, roll, and additively manufacture amorphous metals. Over the coming months, we aim to develop new amorphous alloys, build components in cooperation with various partners from the industry and research, and tap into new areas of application," says start-up head Dr. Hans Jürgen Wachter, setting the course for the start-up.

A nose for sulfur was the secret to success

After hundreds of experiments and several years of research at Saarland University's Chair for Metallic Materials, which is led by Professor Ralf Busch, the doctoral candidates Alexander Kuball, Benedikt Bochtler and Oliver Gross collaborated with Heraeus to develop titanium alloys that are both very light and extremely stable. What makes them special: The new metallic glass substances contain a crucial nonmetallic additive, namely sulfur. It is at first surprising that the lightweight metal titanium can be combined with sulfur in such a way that it is highly stable without becoming brittle and fragile. "Nobody had considered sulfur for 20 or 30 years, because it had never worked in any experiment," explains Oliver Gross.

But these young scientists had the right nose, and they tested sulfur as an additive to various metals. They first found a workable alloy with palladium, nickel and sulfur that had good properties. Then they tried titanium. After approximately 250 experiments, the research team finally found the right balance in the combination of titanium and sulfur. The alloys they developed are almost twice as strong as conventional titanium-based metals of the same density, that is, the same weight. This makes them outstandingly suitable for the production of light, small components for the aerospace industry, for example.

Background: Amorphous metals

Amorphous metals are metallic glasses with properties that resemble those of frozen liquids. They are cooled down from the smelter so rapidly that no ordered structures can form in the solid state. This means, they become amorphous, like a glass. This innovative class of materials therefore exhibits a variety of previously incompatible characteristics and has potential for numerous high-tech applications. The materials are shock-absorbent and scratch-resistant, and they also have very good spring characteristics—interesting for durable injection nozzle diaphragms, as lighter shatter-proof casings for smartphones, or as sharp, durable scalpels and minimally invasive instruments.

About Heraeus

Heraeus, the technology group headquartered in Hanau, Germany, is a leading international family-owned portfolio company formed in 1851. With expertise, a focus on innovations, operational excellence and an entrepreneurial leadership, we strive to continuously improve the businesses of our customers around the world. We create high-quality solutions for our customers and strengthen their long-term competitiveness by combining material expertise with technological know-how. Our ideas are focused on important issues such as the environment, energy, health, mobility and industrial applications. Our portfolio ranges from components to coordinated material systems which are used in a wide variety of industries, including the steel, electronics, chemical, automotive and telecommunications industries.

In the 2016 financial year, the FORTUNE Global 500 listed company generated revenues of €21.5 bn. With approximately 12,400 employees worldwide in more than 100 subsidiaries in 40 countries, Heraeus holds a leading position in its global markets. In 2016, the Foundation for Family Businesses named Heraeus as one of the “Top 10 Family Businesses” in Germany.

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