PRESS RELEASE

Green laser melts pure copper

Fraunhofer IWS applies innovative laser melting system for complex copper components for the first time

(Dresden, August 13, 2020) Creating sophisticatedly shaped plastic parts with the 3D printer is no longer an art process, but an everyday technology. This is quite different with pure copper: Until now, it has not been possible to completely melt the metal to create complex components layer by layer using infrared lasers. As a result, the Fraunhofer Institute for Material and Beam Technology IWS in Dresden is now using a novel additive manufacturing system, which processes the metal almost defect-free with a short-wave green laser. It enables new production approaches which previously could not be realized with pure copper. Thus, complex components made of pure copper and copper alloys can be realized for aerospace and automotive industry and the efficiency of electric motors and heat exchangers can be increased.

Now Fraunhofer IWS is able to design pure copper components with excellent electrical and thermal conductivity. These components enable more efficient electric motors and new heat sinks in power electronics. Furthermore, applications in coil and inductor production are conceivable. Additively manufactured copper components are particularly suitable for compact devices with small installation space, high efficiency and high performance. For example, more efficient and compact heat sinks for future power electronics can be manufactured as well as particular individual coils for electrical drives in satellites, cooling systems in space propulsion systems and many other parts.

Only few other research institutes are equipped with comparable systems

The new laser beam melting system is unique in Saxony – there are only few comparable systems in Germany. Instead of infrared light with a wavelength of 1064 nanometers (millionths of a millimeter), the system utilizes a disk laser with high-energy green light with a wavelength of 515 nanometers. "Previous experiments have repeatedly shown that infrared laser beam sources of up to 500 watts are not efficient enough to completely melt copper," explains Samira Gruber, who supervises the project as a research assistant at Fraunhofer IWS. Only 30 percent of the energy used reaches the copper material – the rest is reflected by the metal. The new green laser

Head of Corporate Communications
Markus Forytta | Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS | Phone +49 351 83391-3614 |
Winterbergstraße 28 | 01277 Dresden | www.iws.fraunhofer.de | markus.forytta@iws.fraunhofer.de

Division Manager Additive Manufacturing
Dr.-Ing. Elena Lopez | Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS | Phone +49 351 83391-3296 |
Winterbergstraße 28 | 01277 Dresden | www.iws.fraunhofer.de | elena.lopez@iws.fraunhofer.de

with a maximum of 500 watts offers a different solution: Here, the copper powder absorbs more than 70 percent of the energy used and melts completely, which in turn permits its application in additive manufacturing.

Pure copper conducts heat and electricity particularly well

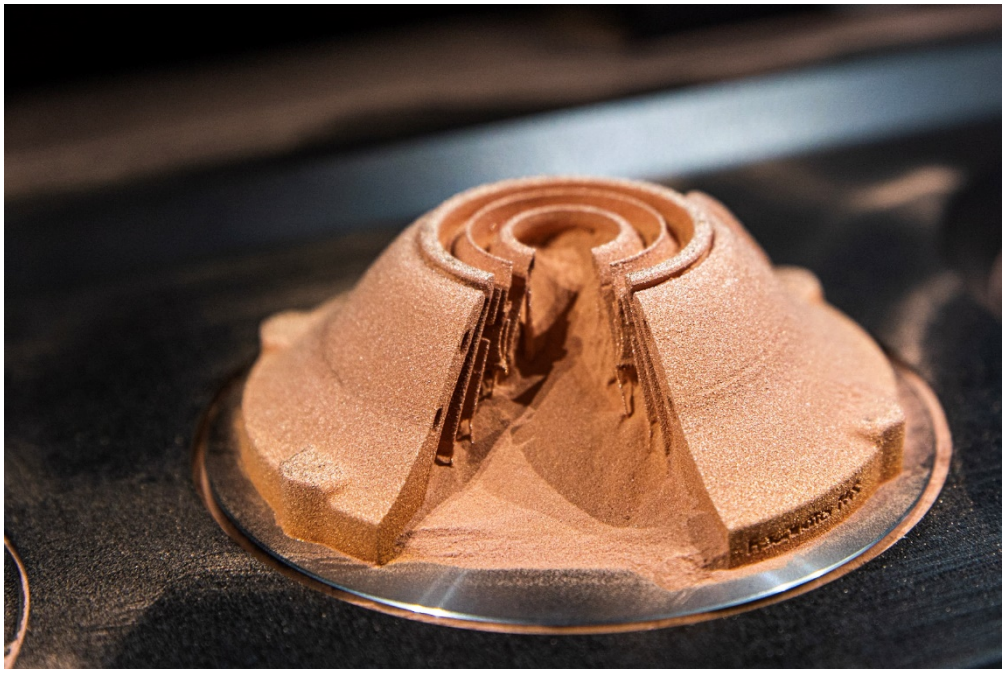
Since copper conducts heat and electricity very well, it constitutes a major improvement if this metal can also be processed in additive production systems. "Components made of pure copper and copper alloys play an important role in aerospace, electronics and automotive industries, for example, in electric drives or as heat exchangers," emphasizes Elena Lopez, head of the additive manufacturing department at Fraunhofer IWS. "Additively manufactured copper parts are superior to many aluminum solutions due to a higher volume-specific conductivity. This is particularly interesting wherever small designs and high performance are required." Many copper parts can already be machined, forged or cast today. However, the implementation of additive manufacturing processes opens up new options to produce highly complex geometries, which are simply not possible with conventional manufacturing.

More performance thanks to compact and efficient design

"The increased geometric flexibility now opens up the chance to further increase the cooling capacity of copper components by utilizing the available installation space optimally and thus extending the service life of the cooled components," explains Samira Gruber. Cooling channels are designed in such a way that gases or liquids can flow with as little pressure loss as possible and complex fin geometries increase the heat-absorbing surface area.

Additive manufacturing: Researchers join forces in Saxony

The new Fraunhofer IWS equipment was realized via the "Smart Production and Materials" performance center. This center is an alliance of Technische Universität Chemnitz, Technische Universität Dresden and the Fraunhofer Institutes IWS, ENAS, IWU as well as IKTS, all of which are researching innovative manufacturing technologies and materials for Industry 4.0. The "TruPrint1000" equipped with a green laser is now located at "Additive Manufacturing Center Dresden" (AMCD). IWS engineers and scientists from TU Dresden collaborate in this center on many further pioneering technologies for additive manufacturing.
More information about AMCD:
https://www.iws.fraunhofer.de/en/centers/additive_manufacturing.html



The new additive manufacturing system completely melts pure copper powder.
© Fraunhofer IWS Dresden

Complex copper parts are manufactured layer by layer – for example heat sinks.
© Fraunhofer IWS Dresden

PRESS RELEASE
No. 07 | 2020
August 13, 2020 || Page 5 | 5

Equipped with a green laser, the "TruPrint1000" now belongs to the "Additive Manufacturing Center Dresden" (AMCD).
© Fraunhofer IWS Dresden