New alloy can directly reduce the weight of heat removal systems by a third

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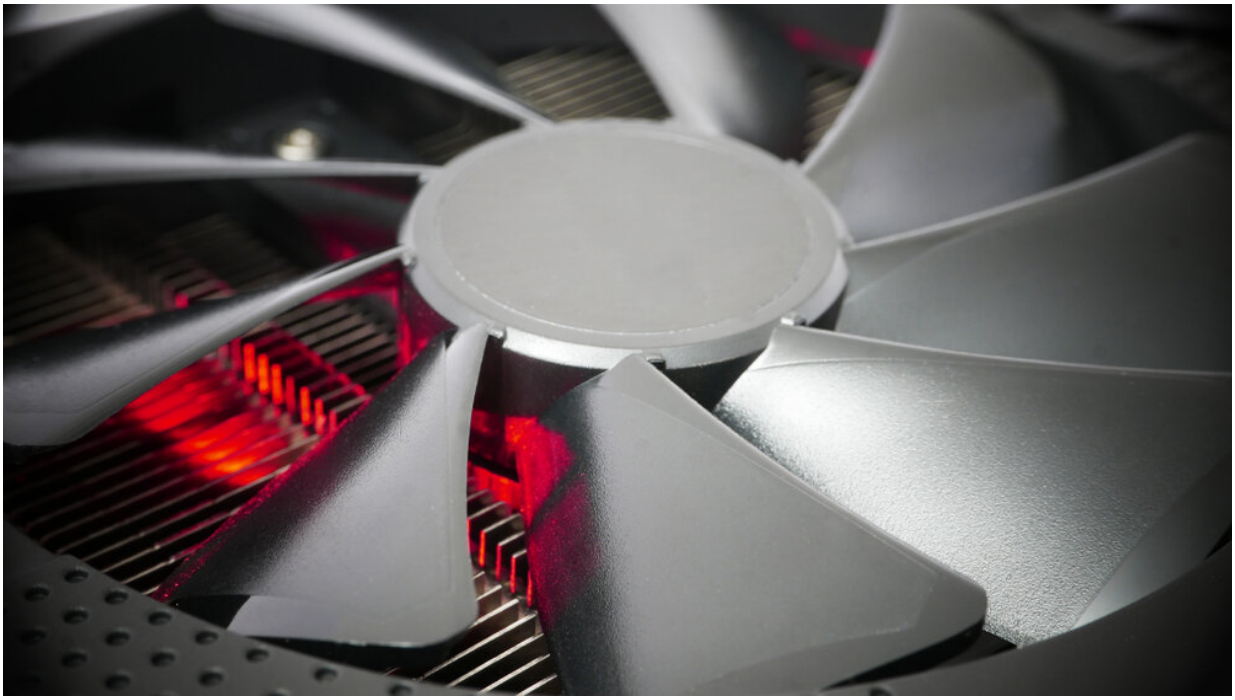

Credit: National University of Science and Technology MISIS

The new alloys created by NUST MISIS scientists in cooperation with LG Electronics will help reduce the weight of radiators and heat removal systems in electric vehicles and consumer electronics by one third. The research results are published in the *Journal of Magnesium and Alloys*.

According to experts, with the development of electronics the problem

of efficient heat removal is becoming more and more acute—with an increase in the productivity of equipment, heat generation also grows. Reducing the temperature directly affects the prolongation of the devices' life cycle. This is especially important for household appliances, electric vehicles, LED panels.

Scientists from NUST MISIS, in collaboration with LG Electronics, have created new high-heat-conductivity magnesium alloys that differ from their counterparts in increased reliability and low cost, and in addition, they can significantly reduce the weight of devices.

"Traditionally, aluminum is used for heat removal, but it turns out to be too massive for modern gadgets. Reducing the weight of devices can significantly reduce energy consumption during operation, as well as reduce greenhouse emissions during transportation, which is becoming increasingly important today. The use of our alloys will reduce the weight of heat-removing elements by a third without losing effciency," said Vyacheslav Bazhenov, associate professor at the Department of Foundry Technology & Artistic Processing of Materials at NUST MISIS.

One of the problems in the operation of magnesium alloys, as noted by scientists, is their ability to catch fire in the air. Due to the addition of calcium and yttrium, scientists managed to significantly increase the ignition temperature, so that new materials can be used in various gadgets without restrictions.

"We wanted to create alloys with a low cost, so we were almost not using expensive elements, which are usually alloyed with magnesium—neodymium, lanthanum, thorium etc. As a result, we had alloys of two compositions: the cheapest—alloyed with silicon, zinc and calcium (Mg-Si-Zn-Ca) with high thermal conductivity and medium strength, and somewhat more expensive—alloyed with zinc, yttrium and zirconium (Mg—Zn—Y—Zr) with high strength and slightly lower

thermal conductivity," said Vyacheslav Bazhenov.

Based on the results of the work, LG Electronics registered patents for a high-heat-conducting magnesium alloy (Mg-Si-Zn-Ca) developed at NUST MISIS and a radiator made of it in the U.S., the European Union, Korea and China.

Currently, the research team is working on new compositions of magnesium-based alloys, which can provide high strength and corrosion resistance along with low cost and high thermal conductivity.

More information: V.E. Bazhenov et al, Design of Mg Zn Si Ca casting magnesium alloy with high thermal conductivity, *Journal of Magnesium and Alloys* (2020). DOI: 10.1016/j.jma.2019.11.008

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