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Nanoparticles make lightweight, strong metal

(*Nanowerk News*) A Missouri University of Science and Technology researcher and his colleagues have created a lightweight but very strong structural metal that could improve energy efficiency in aerospace, automobile, defense, mobile electronics and biomedical applications.

The findings of Dr. Lianyi Chen, assistant professor of mechanical and aerospace engineering and materials science and engineering at Missouri S&T, were published Dec. 24 in the latest issue of *Nature* ("Processing and properties of magnesium containing a dense uniform dispersion of nanoparticles").

Working at the University of California-Los Angeles, Chen and his colleagues used magnesium because it is a light metal with two-thirds the density of aluminum, it's abundant on Earth and is biocompatible. They found a way to mix silicon carbide nanoparticles into a molten magnesium-zinc allow that uniformly dispersed and stabilized the nanoparticles, making a super-strong and lightweight metal.

Through compression tests, Chen and his colleagues proved that the silicon carbide nanoparticle-infused magnesium metal was substantially stronger than conventional metals that did not contain nanoparticles. "The evenly dispersed nanoparticles provide strength throughout the metal and improve plasticity simultaneously," Chen says.

The new metal potentially can make cars and airplanes lighter and more fuel efficient without compromising strength and safety, the researchers say. Because it's light, cell phones could be made even lighter than they are today, and with its high strength, it also could be used as a building material.

Conventional synthesis methods have reached their limits in magnesium and other metals, Chen says. "Ceramic particles have been used in metal matrices to further improve the strength of metals, but they tend clump together, reducing the strengthening efficiency, degrading the metal's plasticity and making them hard to machine," Chen said.

Chen and his colleagues counteracted this issue by developing a nanoparticle dispersion and self-stabilization approach, which leads to the uniform dispersion of 14 percent nanoparticles in the resulting Mg2Zn metal. Significant enhancement of both strength and plasticity was achieved in the resulting metal. "The results we obtained open a way to break the property ceilings of metals," Chen says.

To test the metal, the team used scanning and transmission electron microscopy methods. Images produced show the even dispersal of nanoparticles throughout the metal.

Making it available in the marketplace won't happen anytime soon, however.

"Although the method reported here is scalable in principle, many efforts are still needed to realize large-volume manufacturing from practical applications," Chen says.

Source: *Missouri University of Science and Technology*

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