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University Communication

UH Researchers Create New Flexible, Transparent Conductor

Discovery Brings Bendable Cell Phone, Foldable Flat-Screen TV Closer to Reality

By Jeannie Kever 713-743-0778
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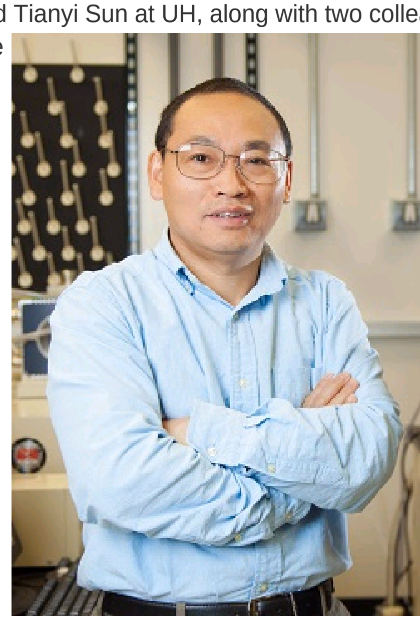
University of Houston researchers have developed a new stretchable and transparent electrical conductor, bringing the potential for a fully foldable cell phone or a flat-screen television that can be folded and carried under your arm closer to reality.

Zhifeng Ren, a physicist at the University of Houston and principal investigator at the Texas Center for Superconductivity, said there long has been research on portable electronics that could be rolled up or otherwise easily transported. But a material that is transparent and has both the necessary flexibility and conductivity has proved elusive – some materials have two of the components, but until now, finding one with all three has remained difficult.

The gold nanomesh electrodes produced by Ren and his research associates Chuanfei Guo and Tianyi Sun at UH, along with two colleagues at Harvard University, provide good electrical conductivity as well as transparency and flexibility, the researchers report in a paper published online Tuesday in Nature Communications.



The material also has potential applications for biomedical devices, said Ren, lead author on the paper.

The researchers reported that gold nanomesh electrodes, produced by the novel grain boundary lithography, increase resistance only slightly, even at a strain of 160 percent, or after 1,000 cycles at a strain of 50 percent. The nanomesh, a network of fully interconnected gold nanowires, has good electrical conductivity and transparency, and has "ultrahigh stretchability," according to the paper.

And unlike silver or copper, gold nanomesh does not easily oxidize, which Ren said causes a sharp drop in electrical conductivity in silver and copper nanowires.

Guo said the group is the first to create a material that is more stretchable and conductive at similar transparency, as well as the first to use grain boundary lithography in the quest to do so. More importantly, he said, it is the first to offer a clear mechanism to produce ultrahigh stretchability.

The grain boundary lithography involved a bilayer lift-off metallization process, which included an indium oxide mask layer and a silicon oxide sacrificial layer and offers good control over the dimensions of the mesh structure.

"This is very useful to the field of foldable electronics," Guo said. "It is much more transportable."

Sun noted that Korean electronics maker Samsung demonstrated a cellphone with a bendable screen in October; LG Electronics has introduced a curved cellphone that is available now in Asia.

But neither is truly foldable or stretchable, instead curving slightly to better fit against the user's face. "For that kind of device, we need something flexible, transparent," Sun said of a foldable phone. "If we want to further that technology, we need something else, and the something else could be the technology we are developing."

Ren noted that, although gold nanomesh is superior to other materials tested, even it broke and electrical resistance increased when it was stretched. But he said conductivity resumed when it was returned to the original dimensions.

That didn't prove true with silver, he said, presumably because of high oxidation.

The work at the University of Houston was funded by the Department of Energy, while that at Harvard was funded by a National Science Foundation grant.

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