Scientists invent lightweight liquid metal materials

February 25 2020, by Zhang Nannan

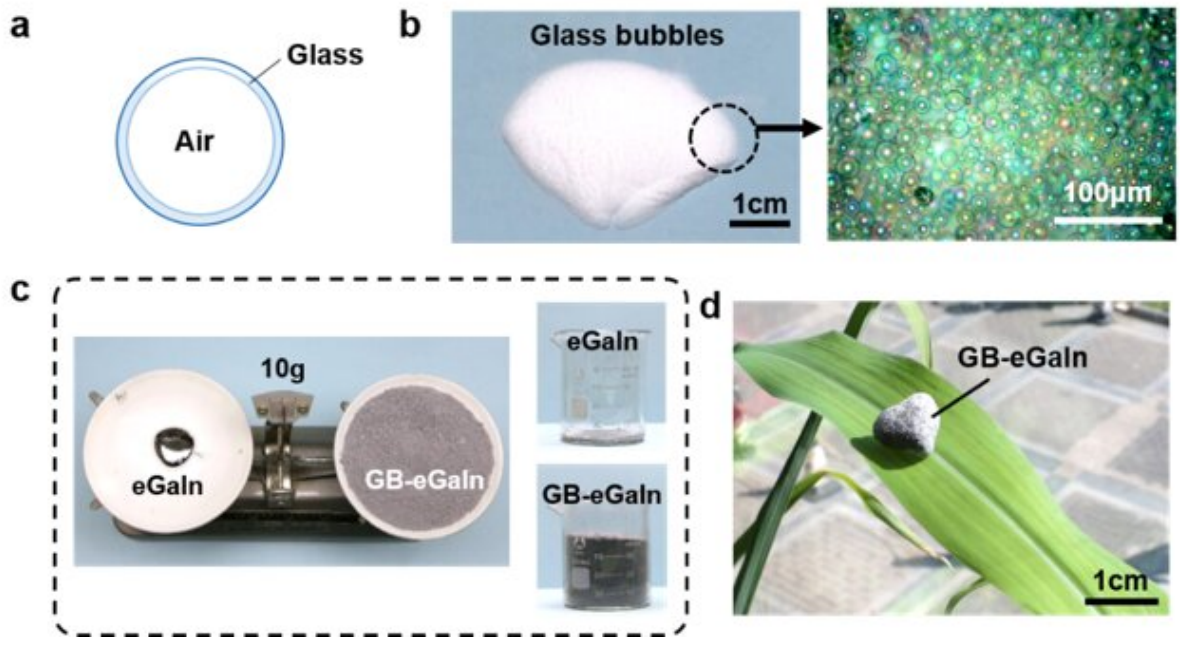

Figure 1. GB-eGaIn. Credit: LIU Jing

Room temperature liquid metal, for example Gallium-based alloy, has high electrical and thermal conductivity, and excellent fluidity. They can be used in various application fields such as flexible electronics, wearable devices, biomedical practices, exoskeleton systems and soft robotics etc. However, components made by liquid metal may heavier than non-metal ones. The density of metal is larger than non-metal

materials like polymer, plastics and wood.

Recently, a joint research team led by Prof. Liu Jing from the Technical Institute of Physics and Chemistry (TIPC) of the Chinese Academy of Sciences and Tsinghua University, proposed a concept termed as "lightweight liquid metal entity" and invented a group of lightweight liquid metal materials. The work was published in *Advanced Functional Materials*.

In their work, a representative composite material GB-eGaIn was fabricated based on eGaIn and hollow glass bubble. GB-eGaIn has low density, high ductility and stiffness variability.

According to their study, GB-eGaIn is able to be molded into thin sheets due to its high adhesion. The sheet can be rolled or folded easily and "transformed" to 3-D structure via folding, cutting or assembling processing.

GB-eGaIn sheet also performs well in phase transition. By controlling the temperature regulation, the sheet can shift easily between completely soft state and rigid metal object. The results indicated GB-eGaIn's capability for constructing temperature-tuned functional components.

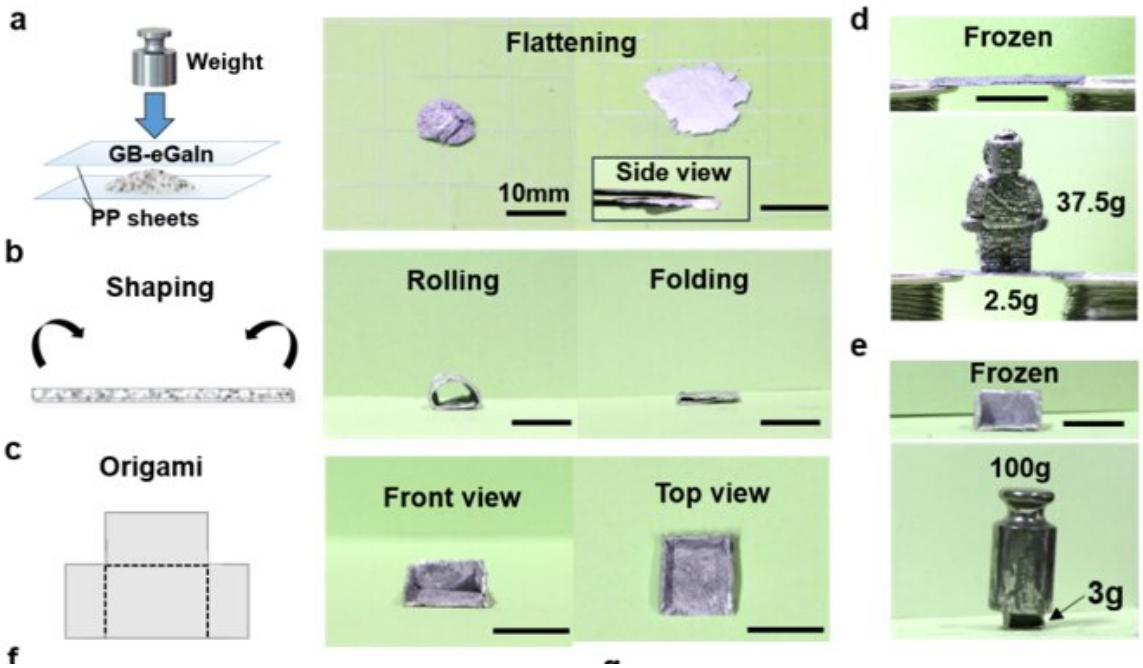

Figure 2. Planar Structure of GB-eGaI. Credit: LIU Jing

Combining with water-proof package materials, GB-eGaIn can realize floating and sinking behavior by adding of water. According to the recorded resistance variation of the same component both in water and after drying, researchers from Prof. LIU's team proved that GB-eGaIn has only slight change even after reuse for 8 times.

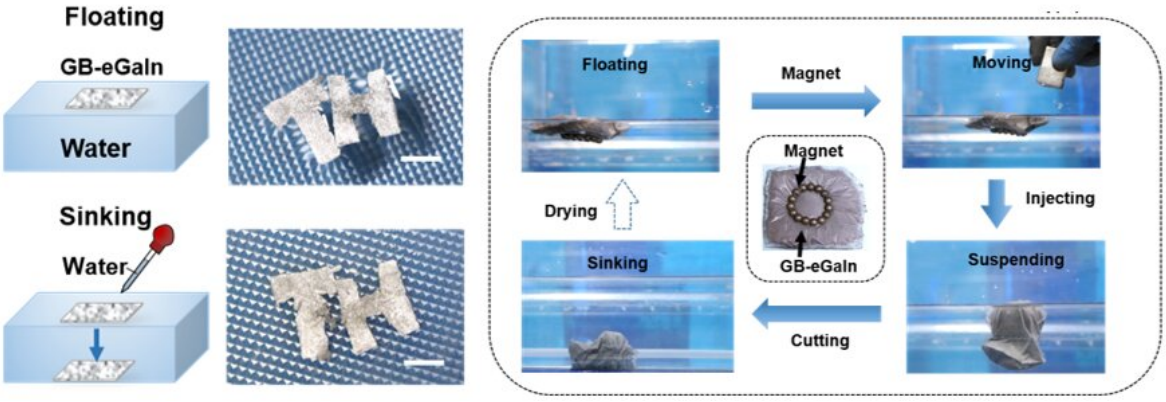

Figure 3. Floating behavior of GB-eGaIn in planar and 3-D structure. Credit: LIU Jing

In the study, they also demonstrated GB-eGaIn components combined with magnet can be controlled moving, suspending and sinking under regulation of external magnetic field and package materials. It offered potential use in developing advanced smart underwater devices.

More information: Bo Yuan et al. Lightweight Liquid Metal Entity, *Advanced Functional Materials* (2020). DOI: 10.1002/adfm.201910709

Provided by Chinese Academy of Sciences