Powderized Liquid Metal Powder Based on Gallium–Indium Eutectic and Its Applications to Conductive Composites

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Eutectic mixture of gallium and indium (EGaIn) is one of liquid metals because of its melting point below the room temperature. Hence, it exhibits high electric and thermal conductivities, fluidity and deformability. Recently, liquid metal–polymer hybrids and composites have been developed, enabling us to access unique electric and thermal properties.[1] However, there are still limited ways of easy and robust strategies to prepare those composites due to the high surface tension of liquid metals.[2] Herein, it has been demonstrated that surface modification of liquid metal microparticles with organic surfactants prevents the coalescence of the particles and affords powderized liquid metal microparticles (LMP). Liquid metal–polymer composites can be prepared with easy ways, like mixing and solution processes.

LMP was prepared by ultrasonication of bulk EGaIn in ethanol in the presence of dodecanethiol as a surfactant, followed by wash and freeze-drying. The LMP can be treated and weighed with a spatula like a powder, while pressing or shearing induces the coalescence of the microparticles and recovery to bulk EGaIn. The LMP is composed of several micrometer particles. The surfactant covers the surface of the microparticles, and its weight fraction is estimated to be about 0.25 wt% (Figure 1). LMP–PDMS composites exhibit electric conductivity, and the LMP-coated acrylate polymer network changes its conductivity by swelling. Therefore, it has been demonstrated that the LMP-based method enables us to develop functional composite materials.

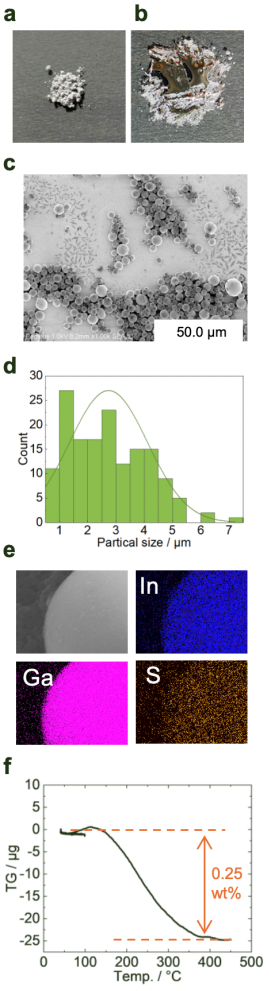

Figure 1. Photographic images of LMP (a) before and (b) after shearing. (c) FE-SEM image, (d) size distribution, (e) EDX images, and (f) TGA profile of LMP.

References

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