

## Supporting Information

For

### A Highly Stretchable and Sintering-Free Liquid Metal Composite

### Conductor Enabled by Ferrofluid

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Table S1 Materials used for the preparation of LM ferrofluid and conductive LME composite.

<b>LM Ferrofluid</b>	
Materials	Usage
EGaIn	1.0 mL
Fe@Cu Particles	2.8 g
HCl (2M)	4.0 mL
<b>Conductive LME</b>	
Materials	Usage
Ecoflex 0030 Part A	3.0 g
Ecoflex 0030 Part B	3.0 g
LM Ferrofluid	9.0 g

Table S2. Comparisons of the stretchability and composition of our LME composite with that in the previously reported works.

<b>Materials</b>	<b>Strain</b>	<b>Mass ratio</b>	<b>Reference</b>
<b>PDMS:LM</b>	<b>125%</b>	<b>1:6.6L</b>	<b>Ref. 1</b>
<b>PVC:LM</b>	<b>600%</b>	<b>1:2.64</b>	<b>Ref. 2</b>
<b>PU:PLM</b>	<b>500%</b>	<b>50:33</b>	<b>Ref. 3</b>
<b>LM:Fe: PDMS</b>	<b>20%</b>	<b>1.25:2:1</b>	<b>Ref. 4</b>
<b>LM:Fe:PDMS</b>	<b>30%</b>	<b>1.25:4:1</b>	<b>Ref. 5</b>
<b>PDMS:LM</b>	<b>50%</b>	<b>1:1.32</b>	<b>Ref. 6</b>
<b>PDMS:LM</b>	<b>90%</b>	<b>1:1.32</b>	<b>Ref. 7</b>
<b>PDMS:LM</b>	<b>400%</b>	<b>1:1.98</b>	<b>Ref. 8</b>
<b>EVA:Ag:LM</b>	<b>900%</b>	<b>1:0.7:2</b>	<b>Ref. 9</b>
<b>SEBS:LM</b>	<b>800%</b>	<b>1:2</b>	<b>Ref. 10</b>
<b>Ecoflex:Fe@Cu:LM</b>	<b>650%</b>	<b>1:0.17:0.43</b>	<b>Our work</b>

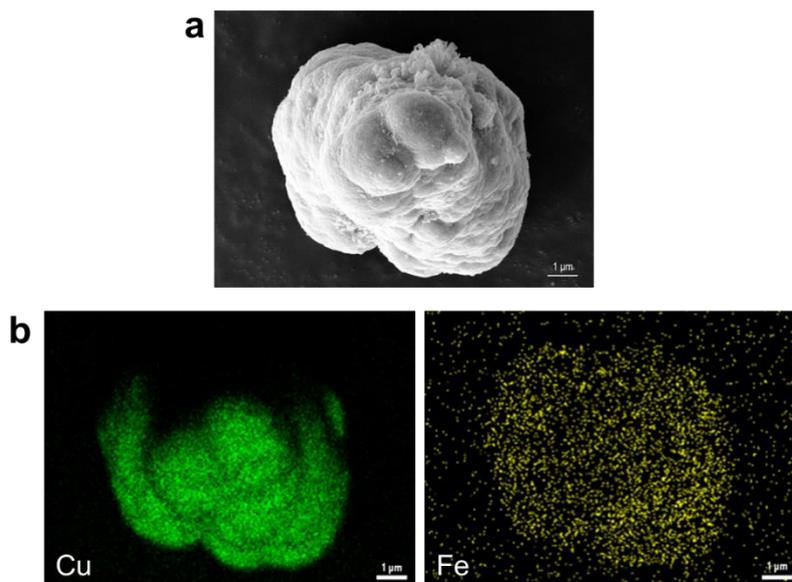


Figure S1. (a) The SEM image of the Cu@Fe particle with a diameter of 8.6 μm. (b) The EDS images of the Cu@Fe particle.

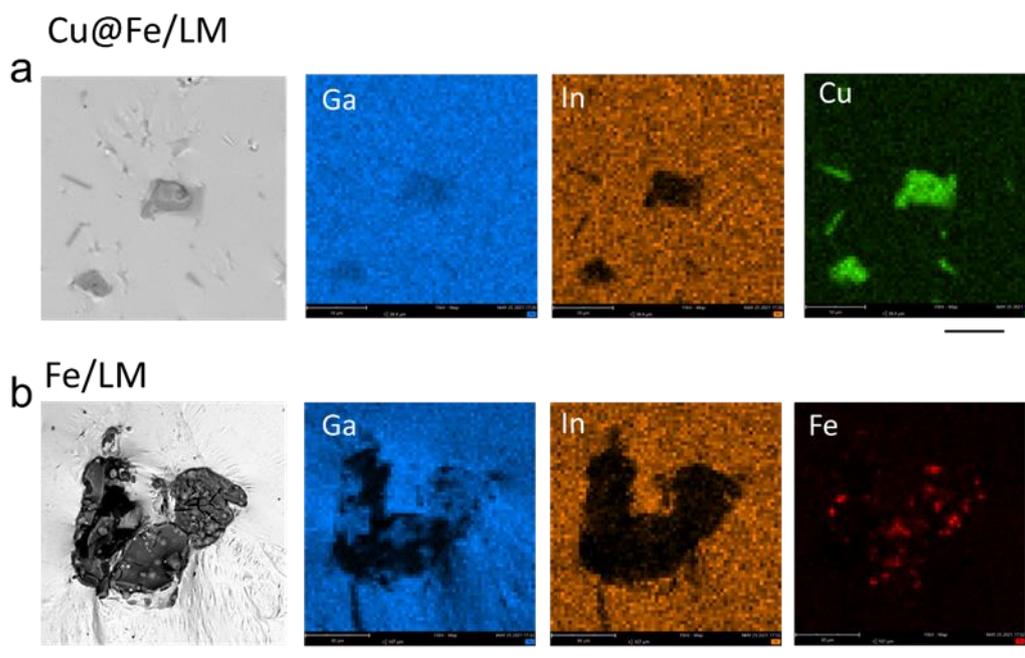


Figure S2 SEM and related EDS images of the LM ferrofluid surface with dispersed Cu@Fe microparticles (a) and Fe microparticles (b). Scable bar: 10 μm for (a) and 30 μm for (b).

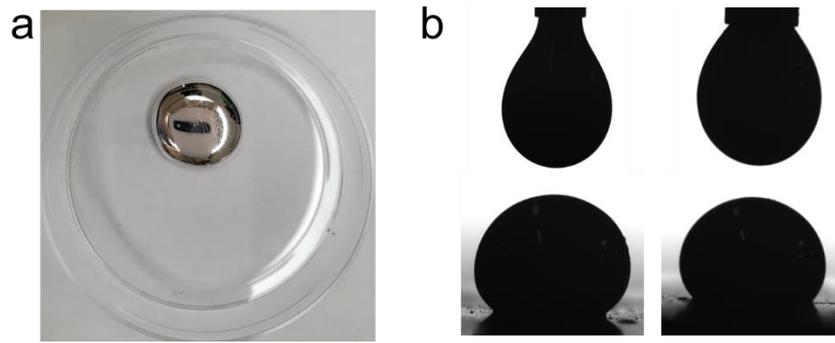


Figure S3. (a) The LM can maintain the shape of spheroidicity. (b) The photographs of the contact angle when the Cu@Fe particles at a mass ratio of 0% (left) and 40% (right).

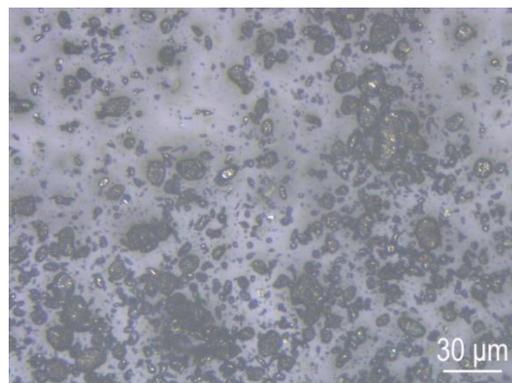


Figure S4. Optical photograph of conductive LME pre-gel under stirring at 800 rpm for 10 min.

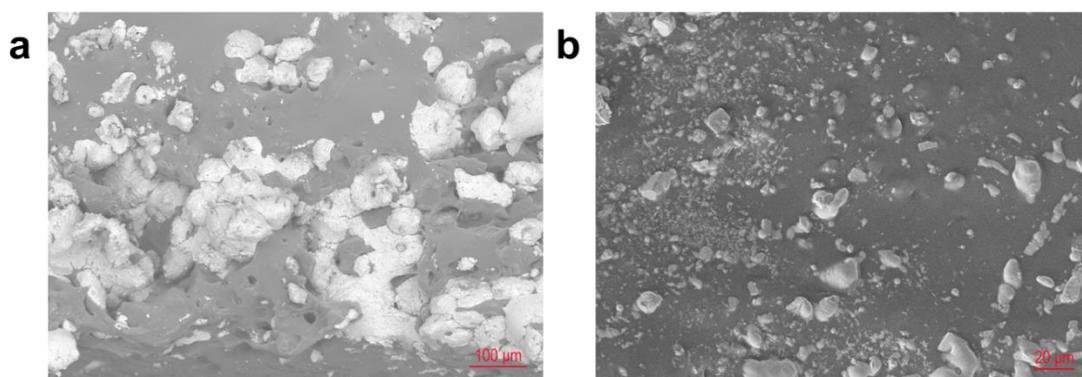


Figure S5. (a) The SEM image of the LME composites applied with the magnetic field shows that the MLM particles merge together. (b) The SEM image of the composite without the magnetic field shows the LM ferrofluid particles were evenly dispersed to the elastomer.

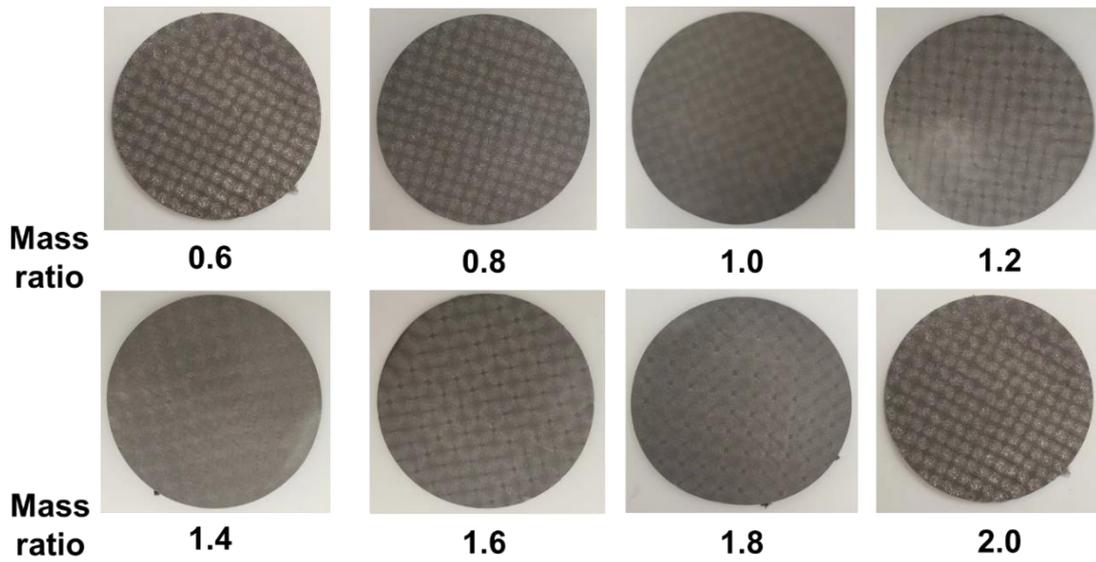


Figure S6. The photographs of the LM ferrofluid at different mass ratios. The conductive LME composite can be conductive with the mass ratio of LM ferrofluid above 0.6.

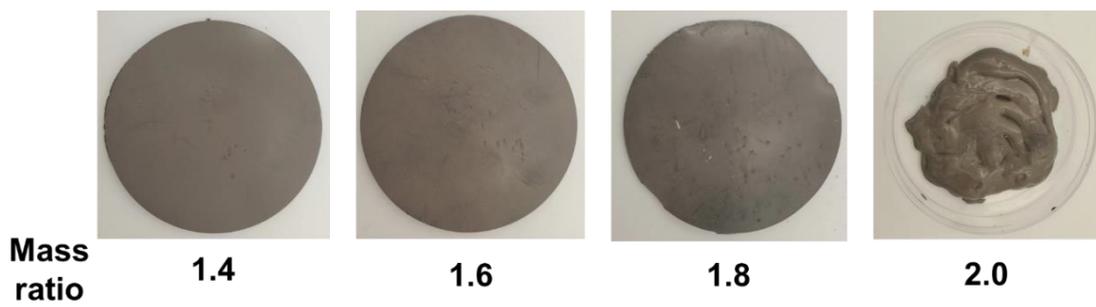


Figure S7. The photography of the pure LM at different mass ratios. When the mass ratio reached 2.0, the composite loses its mobility.



Figure S8. Schematic illustration of the electric measurement of the LME composite by contacting the Cu taper with the bottom conductive layer.

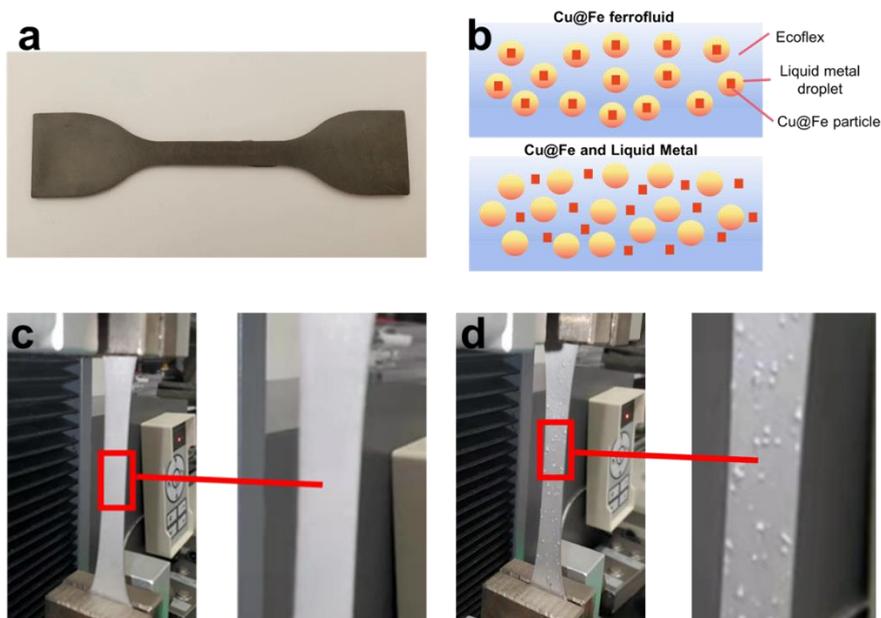


Figure S9. (a) Optical image of tensile test standard. (b) Schematic of the Cu@Fe ferrofluid and Cu@Fe and liquid metal (c) The photograph of the Cu@Fe ferrofluid in Ecoflex when the strain was 200%. (d) The photograph of the Cu@Fe and liquid metal in Ecoflex when the strain was 200%.

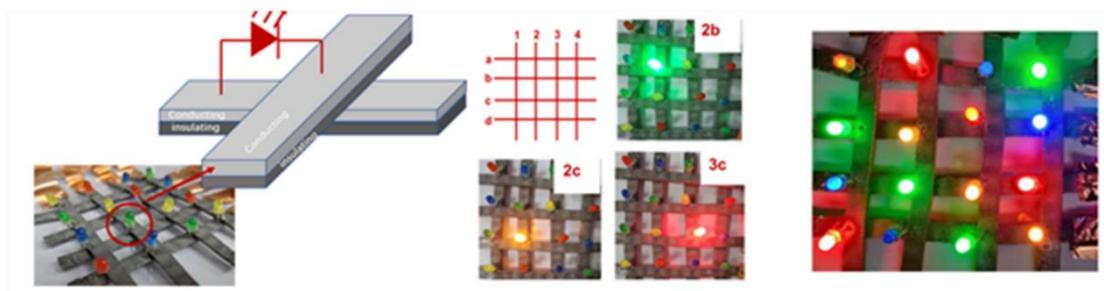


Figure S10. LED array circuit fabricated on two-layered Janus films.

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