Supporting Information

Self-Integratable, Healable and Stretchable Electroluminescent Device Fabricated via Dynamic Urea Bonds Equipped in Polyurethane

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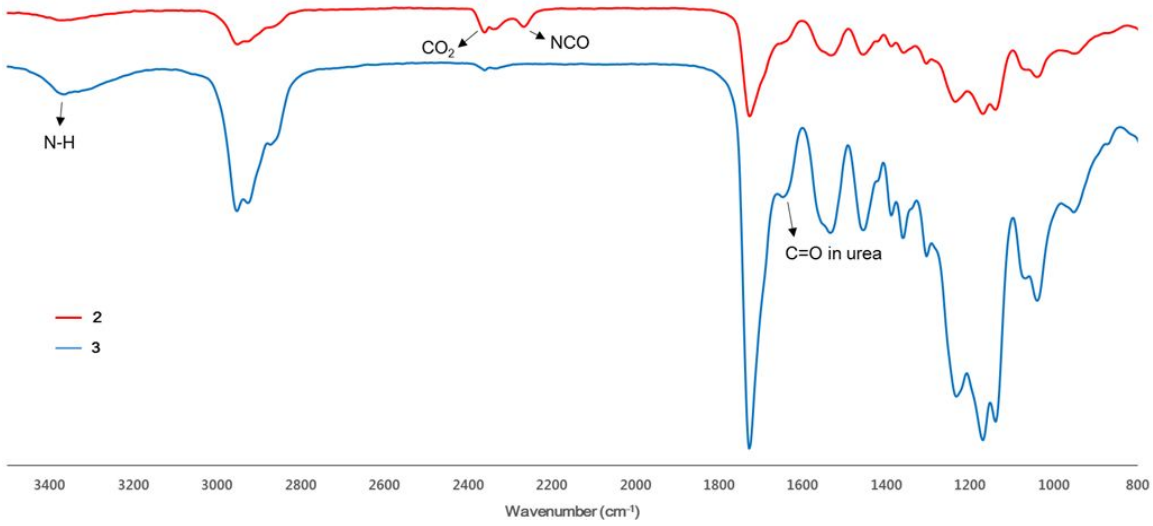

Figure S1. FTIR spectra of **2** (red) and PEDUB (blue).

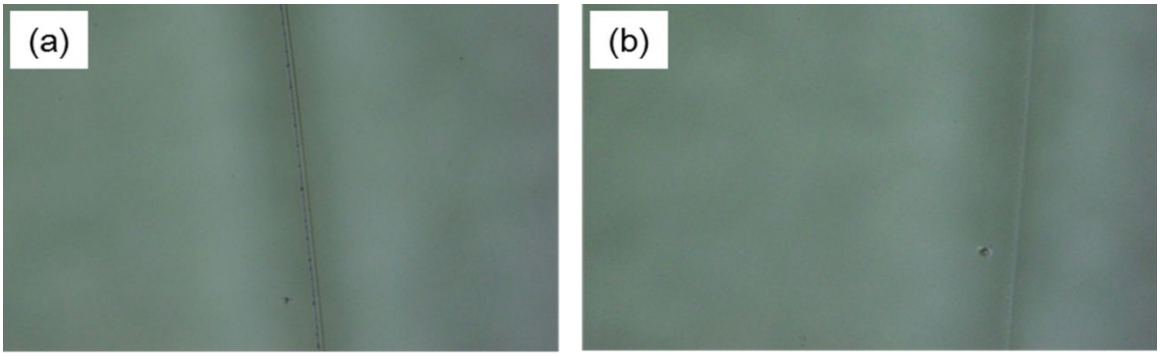

Figure S2. Top view of the cut on the PEDUB film (a) before and (b) after heat treatment at 60 °C for 10 min.

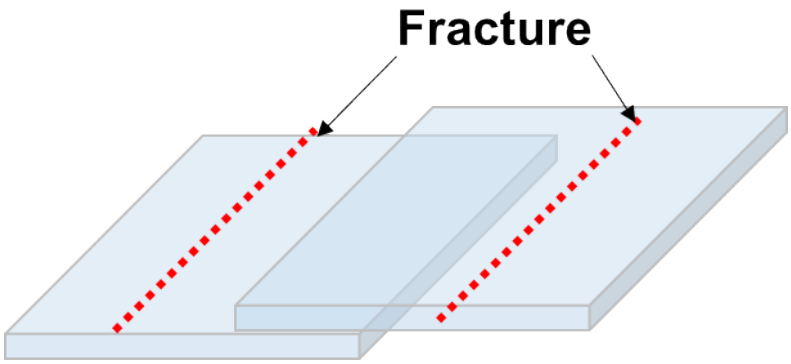

Figure S3. Schematic diagram of fracture locations of the self-integrated sample.

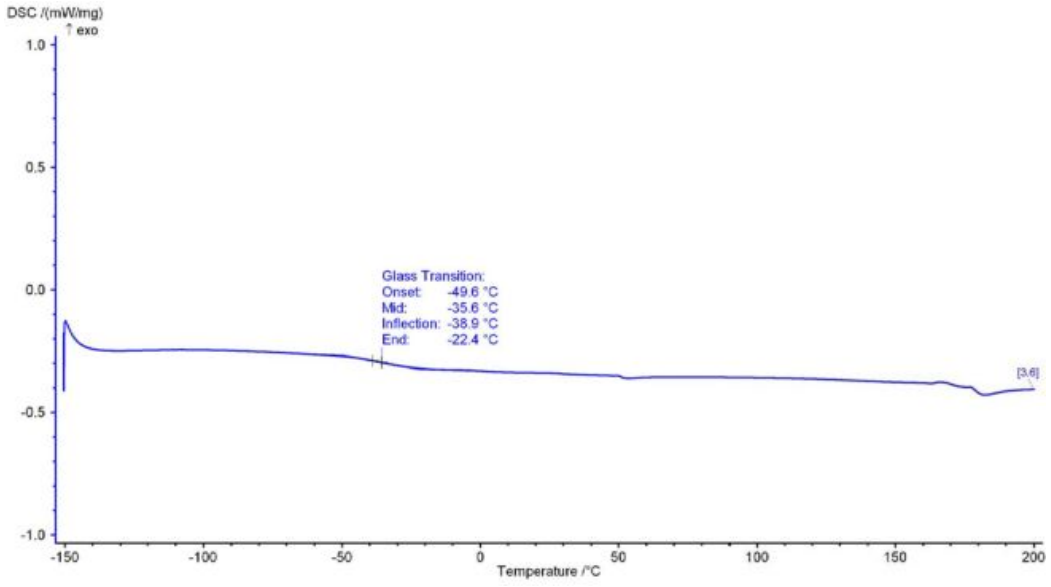

Figure S4. DSC curve of PEDUB. The sample was heated to 200 °C, cooled to -150 °C, and then heated to 200 °C. This curve was obtained during the second heating scan.

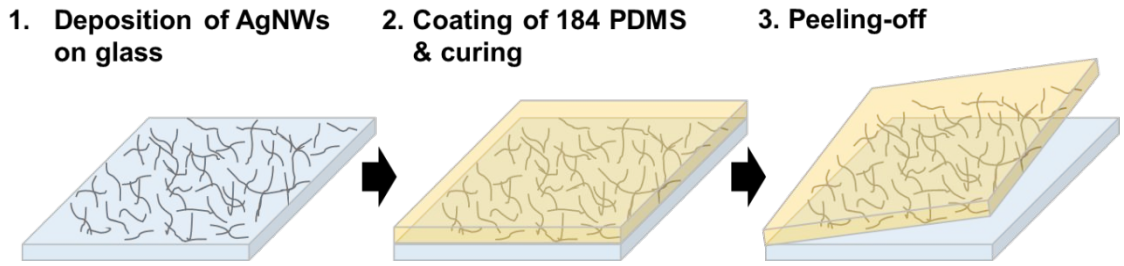

Figure S5. Schematic diagram of the fabrication of a sheet with AgNWs embedded beneath the PDMS surface.

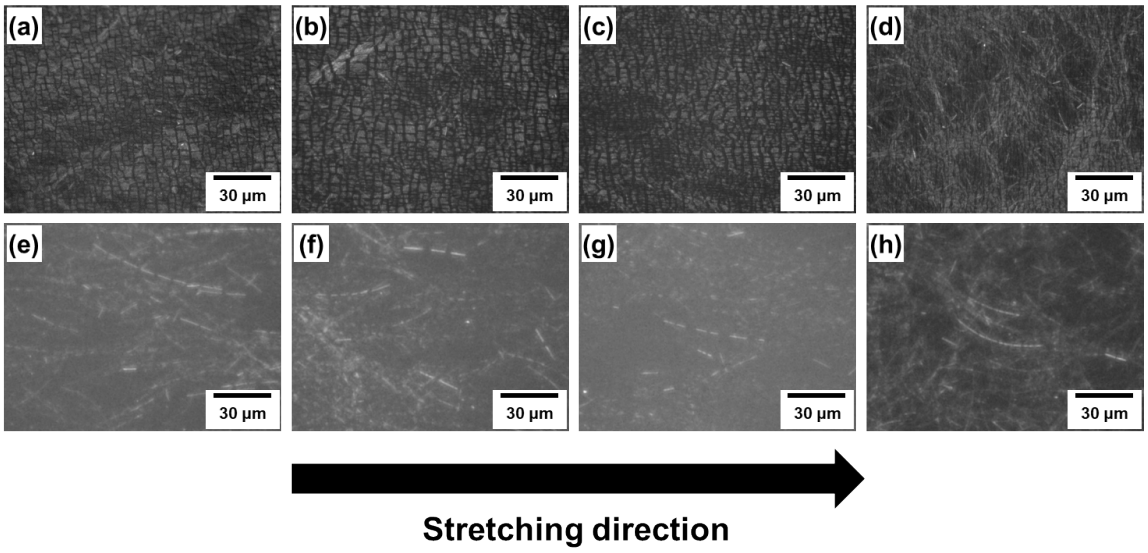

Figure S6. SEM images of PEDUB/AgNWs/PDMS during the stretch-and-release tests: (a)-(d) under 100% strain. (e)-(h) released state. (a),(e) 2,500th, (b),(f) 5,000th, (c),(g) 7,500th, and (d),(h) 10,000th cycles.

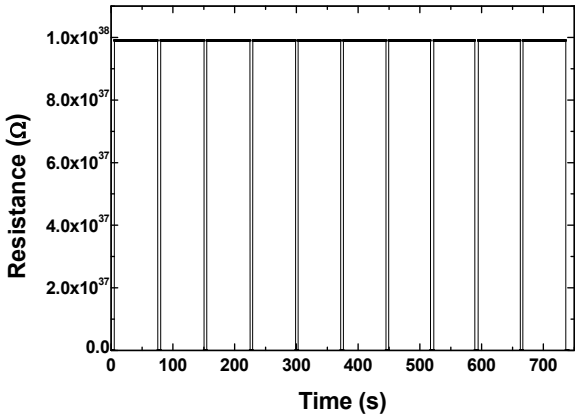

Figure S7. Resistance change of sample with AgNWs embedded beneath the PDMS surface upon application of 100% strain.

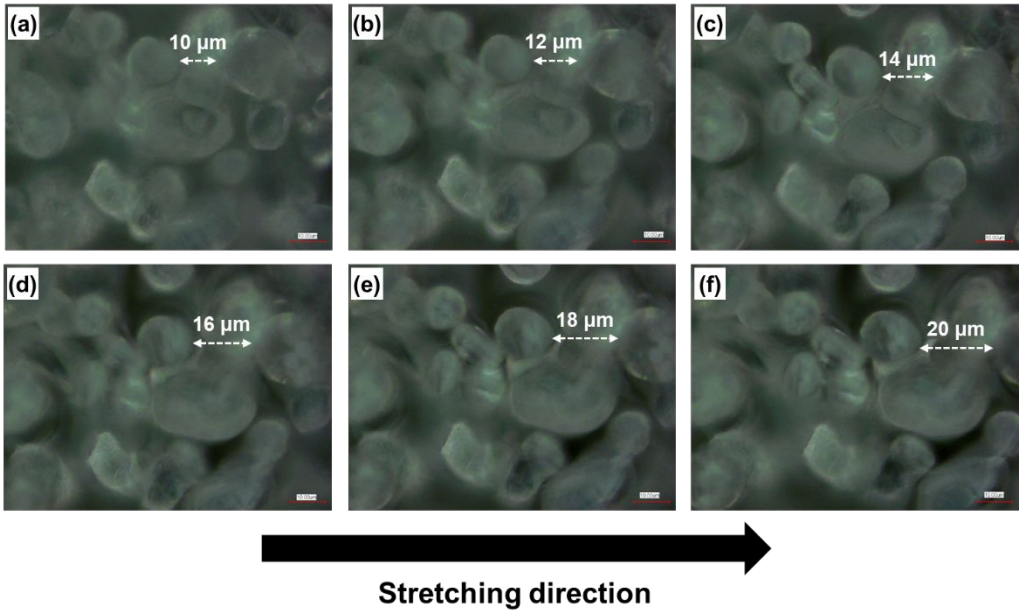

Figure S8. Micrographs of ZnS particles dispersed in cured PEDUB. (a) Pristine state. Stretched state under (b) 20%, (c) 40%, (d) 60%, (e) 80%, and (f) 100% strain.

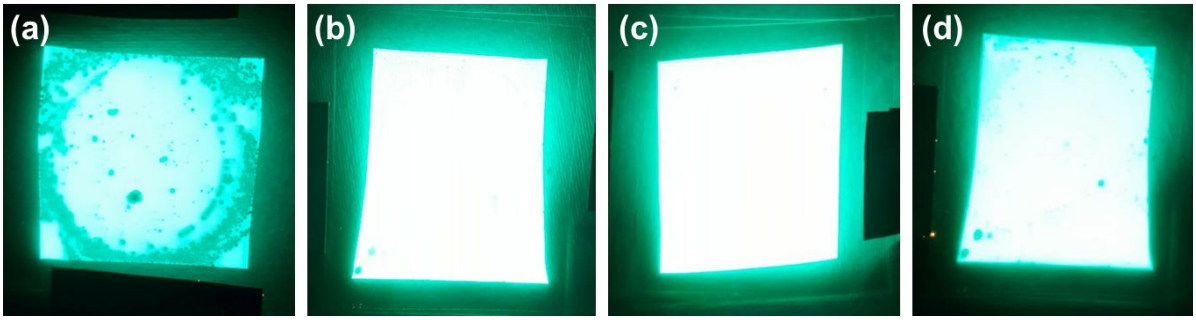

Figure S9. Light emitting devices with varying thickness of EL component: (a) 100 μm, (b) 75 μm, (c) 50 μm, and (d) 40 μm. The luminance at each thickness was 58.4, 78.9, 82.4, and 71.4 cd/m^2 in that order. The device was driven by applying 300 V at 500 Hz.

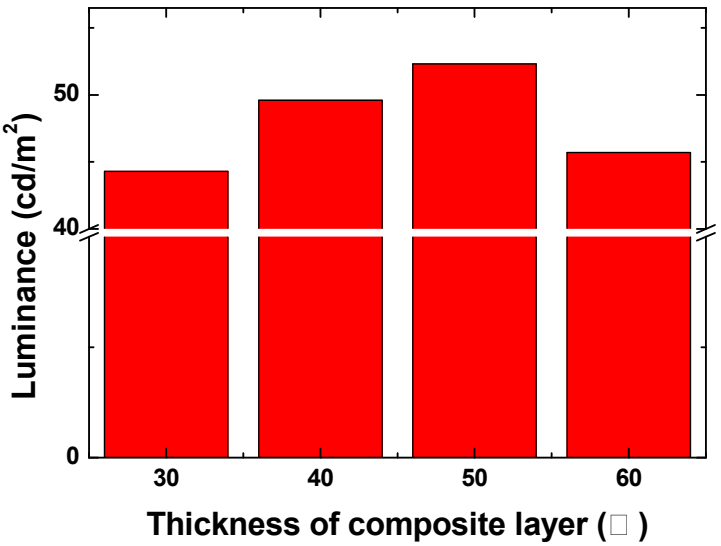

Figure S10. Luminance of the device with various thickness of the EL composite layer. The device was driven by applying 300 V at 300 Hz.

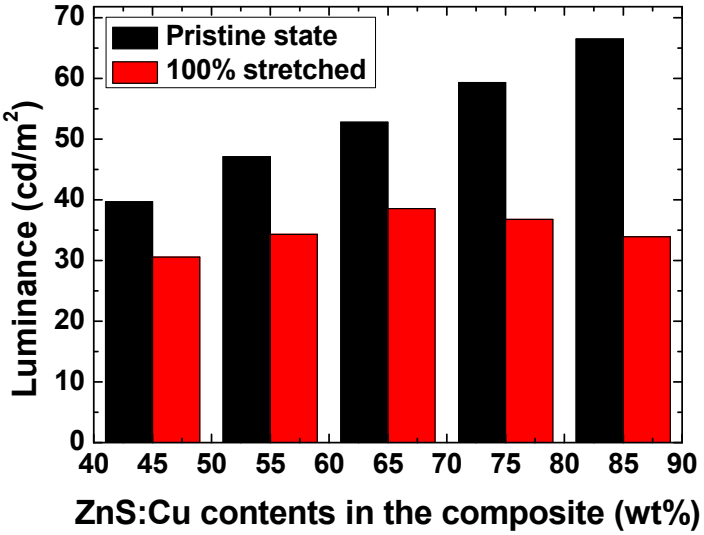

Figure S11. Luminance of the device with varying contents of ZnS:Cu microparticles in the composite (thickness: 50 μm). The device was driven by applying 300 V at 300 Hz.

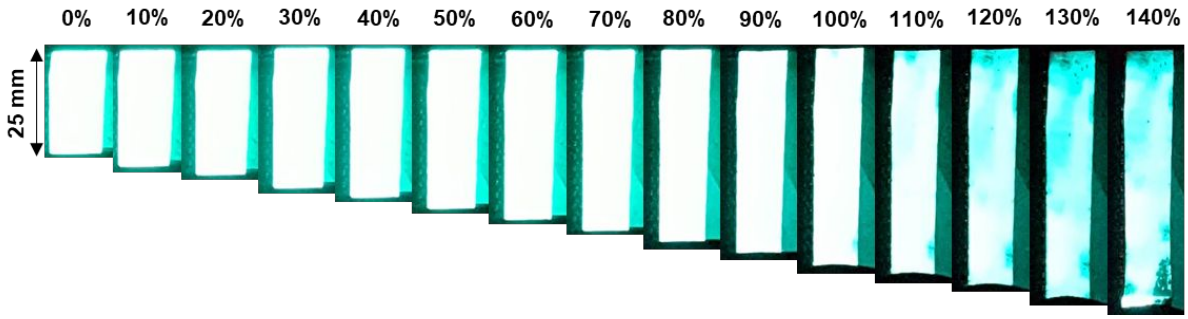

Figure S12. Optical images of the EL device under various applied strain levels.

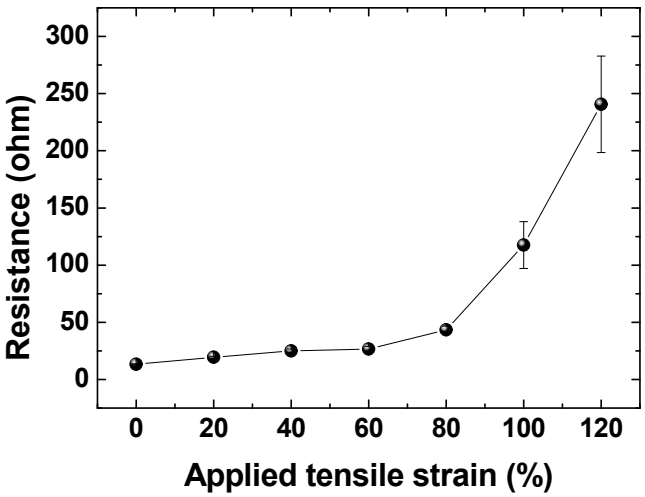

Figure S13. Average resistance of AgNW electrode with applied tensile strain (including standard deviation). Resistance is the average of 9 point measurements at different locations on a 50 mm by 50 mm sample. When the strain is more than 100%, it can be seen that the standard deviation rapidly increases because the variation in resistance according to the measurement location abruptly increases.

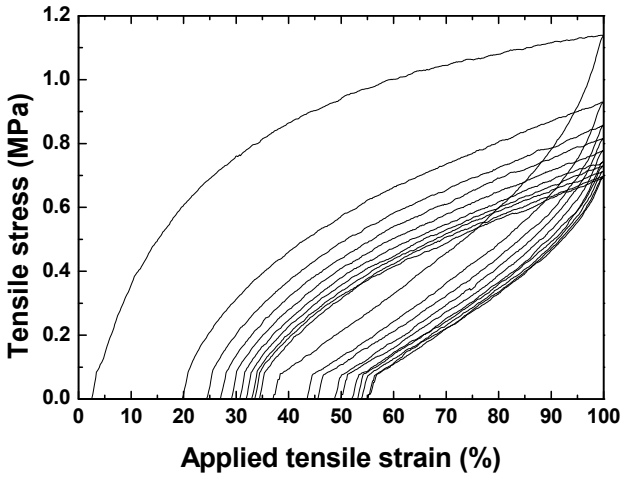

Figure S14. Tensile stress of the ZnS:Cu-PEDUB composite film during 10 cycles of the stretch-and-release test employing up to 100% strain.

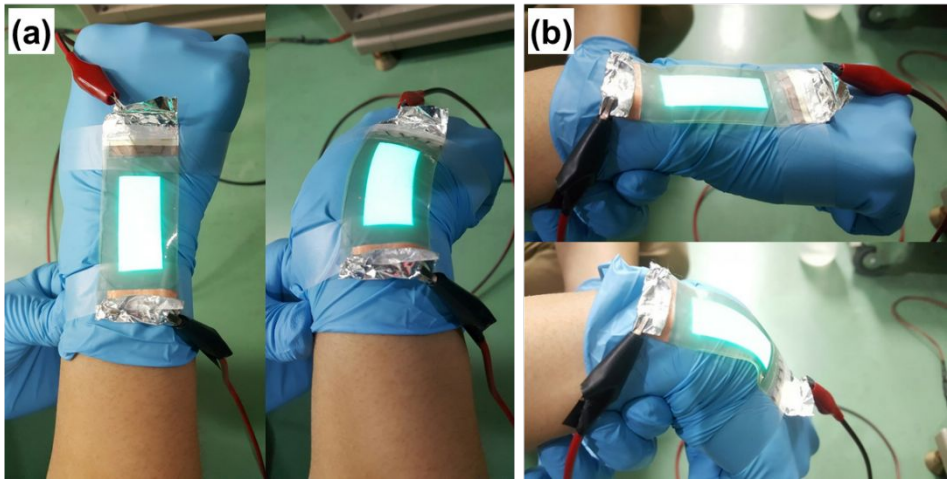

Figure S15. Fabricated device attached to the back of the wrist emitting light without noticeable degradation in brightness after movement of the joints. (a) Top and (b) side views.

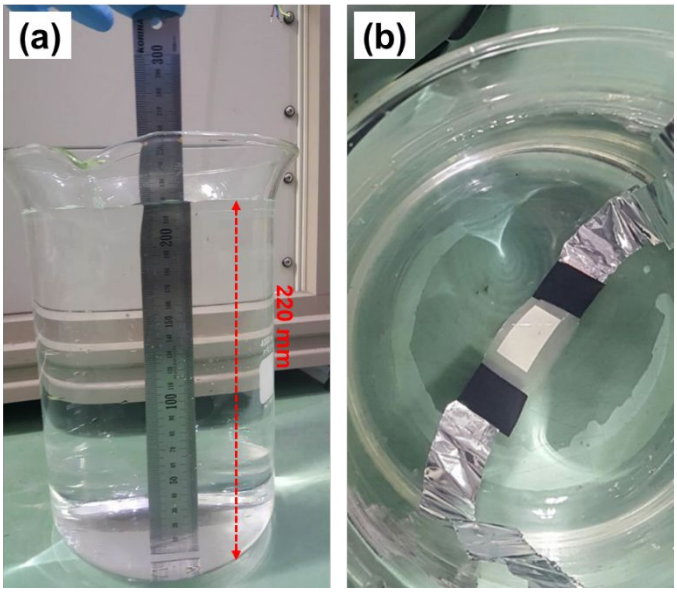

Figure S16. (a) Water-filled bath used to evaluate waterproofness. (b) Sample immersed in water during the waterproof test.

Figure S17. Photograph of 3 types of doped ZnS particles irradiated by UV lamp (λ_{ex} = 300 nm).

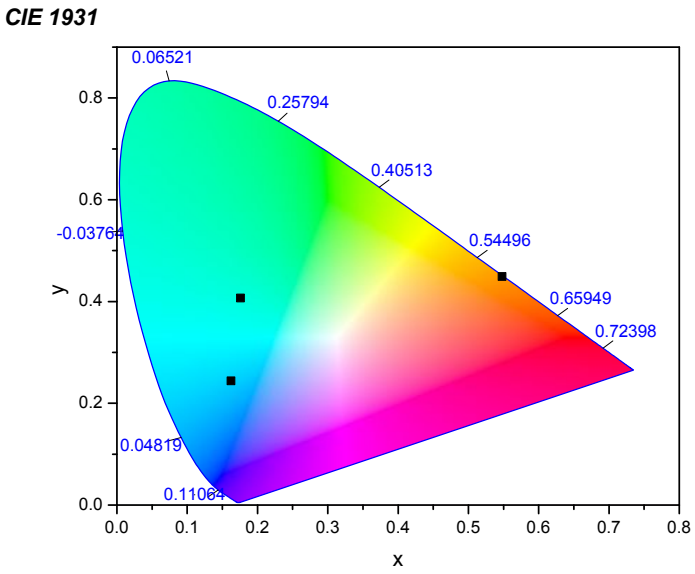

Figure S18. CIE diagram of the PL of the ZnS-based particles revealing that blue (0.162, 0.244), green (0.176, 0.407), and orange (0.548, 0.449) lights are emitted.

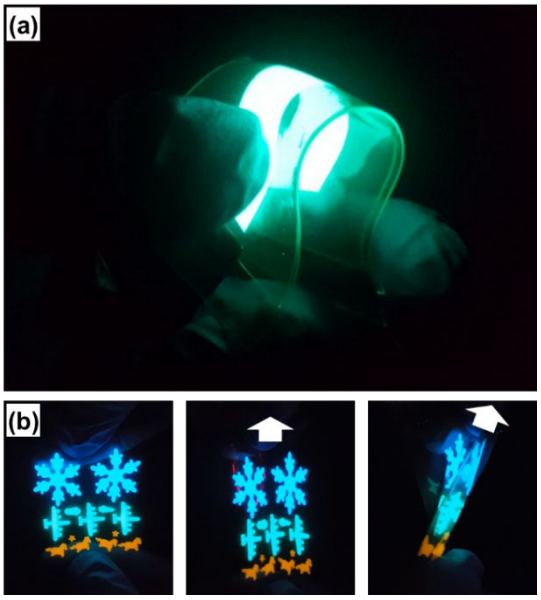

Figure S19. (a) Bent EL device. (b) Various shapes of light-emitting elastomer in the unstretched and stretched states.

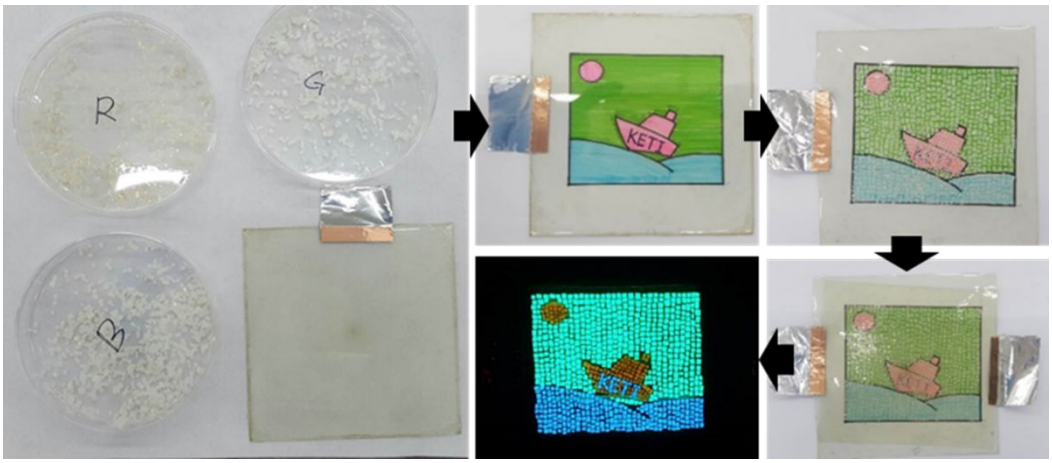

Figure S20. Fabrication of stretchable light-emitting picture starting from the preparation of components (electrode and three types of composite pieces with different particles), to mosaic-like assembly, to lamination, and finally, to mild heating at 60 °C for 10 min.

Movie S1. A light emitting device under significant mechanical deformations in water.

Movie S2. A light emitting device before and after the process of cutting.

Movie S3. Light emitting elements of various shapes under significant mechanical deformations.

Movie S4. A light emitting picture under stretching up to 100% strain.