ADVANCED MATERIALS

Supporting Information

for *Adv. Mater.,* DOI: 10.1002/adma.201500839

Millimeter Thin and Rubber-Like Solid-State Lighting Modules Fabricated Using Roll-to-Roll Fluidic Self-Assembly and Lamination

*Se-Chul Park, Shantonu Biswas, Jun Fang, Mahsa Mozafari, Thomas Stauden, and Heiko O. Jacobs**

Supporting Information

Millimeter Thin and Rubber-Like Solid-State Lighting Modules Fabricated Using Roll-to-Roll Fluidic Self-Assembly and Lamination

*Se-Chul Park, Shantonu Biswas, Jun Fang, Mahsa Mozafari, Thomas Stauden, and Heiko O. Jacobs**

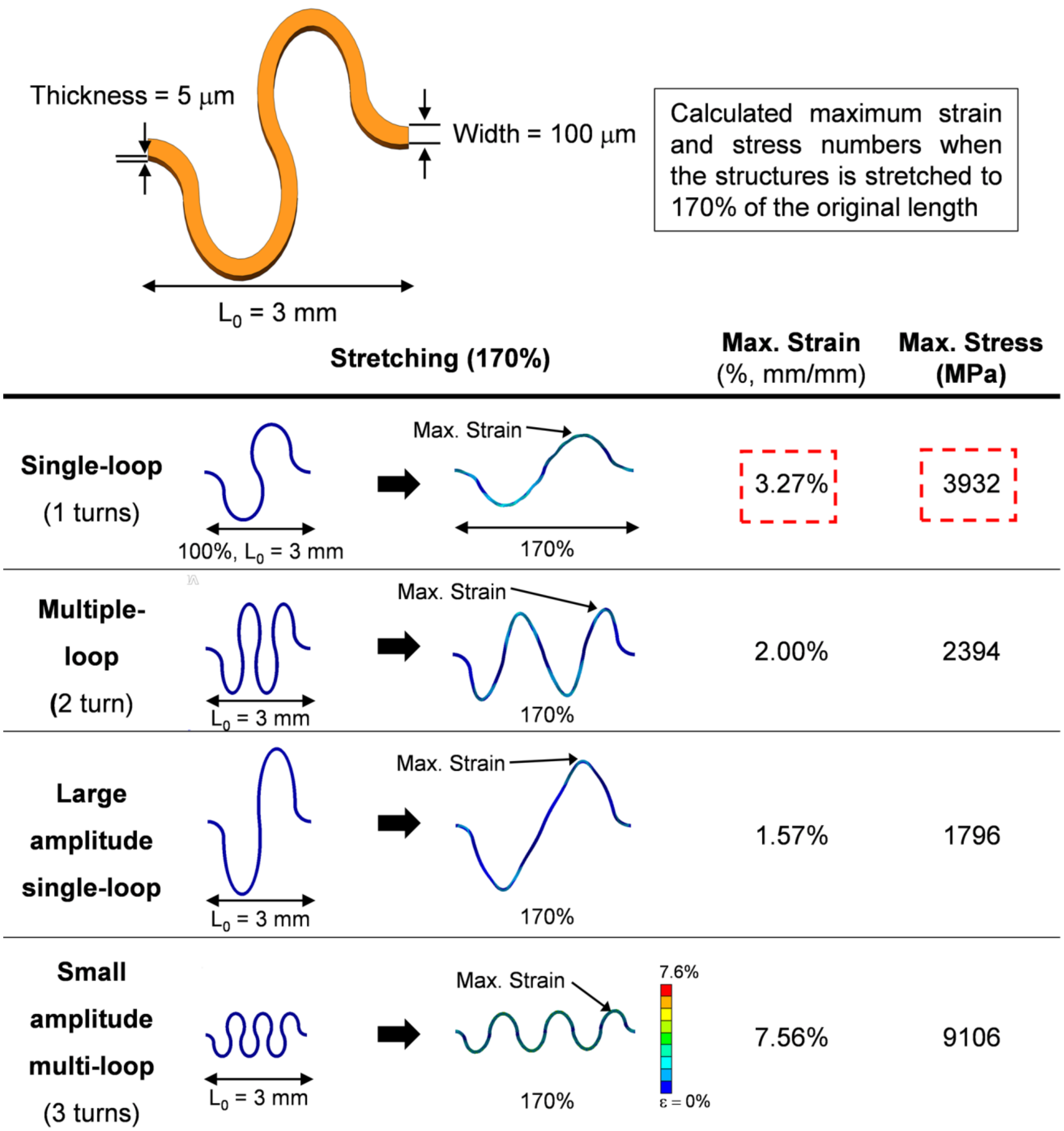

Figure S1 *Comparison of mechanical properties of various interconnect designs such as large amplitude, small amplitude with many turns.*

We compared a “single loop design” with a “multiple loop compressed arc design” which confirmed that the strain and stress reduces with an increased number of windings and path length of the looped interconnecting line. Next, we compared a “large-amplitude single-loop design” with a “small-amplitude multi-loop design” which had an identical path length along the trajectory of the loops. The large amplitude design leads to a reduction of the stress and strain. The design that we choose in the end was a compromise. We decided to limit the amplitude to 0.8 mm which leaves a sufficiently large space. The space is used to provide four redundant connections to the straight-wire-metal-mesh which connects to the top contact of the LEDs.

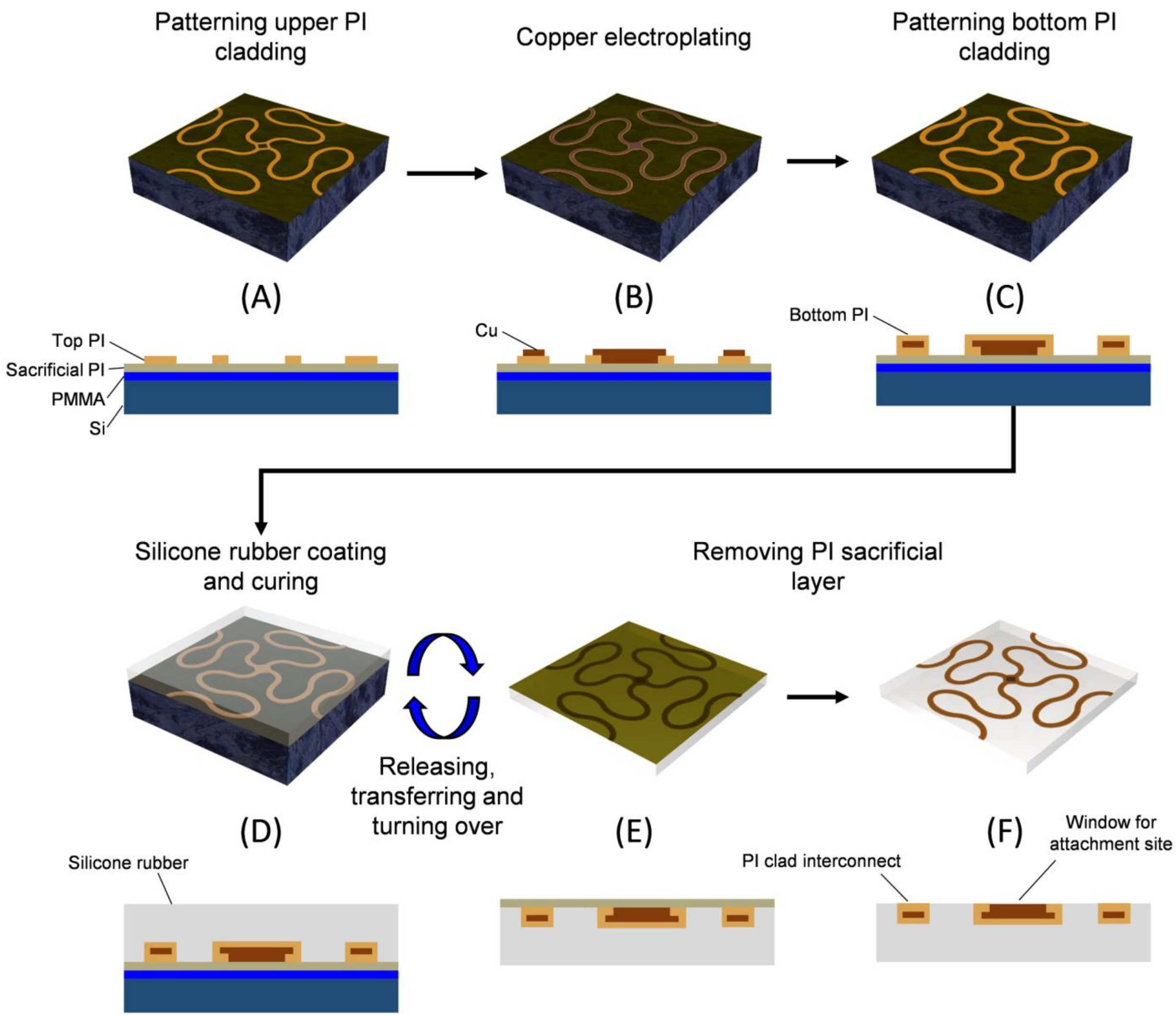

Figure S2 *Fabrication procedure of the bottom electrode. (A) Patterning of the upper polyimide (PI) cladding on the Si substrate with PMMA releasing layer and PI sacrificial layer. (B) Electroplating copper based conductive traces. (C) Patterning bottom PI cladding on top of copper traces. (D) Coating and curing silicone rubber substrate. (E) Releasing and transferring the bottom electrode to the silicone substrate from the Si substrate. (F) Removing the PIsacrificial layer using a reactive ion etch.*

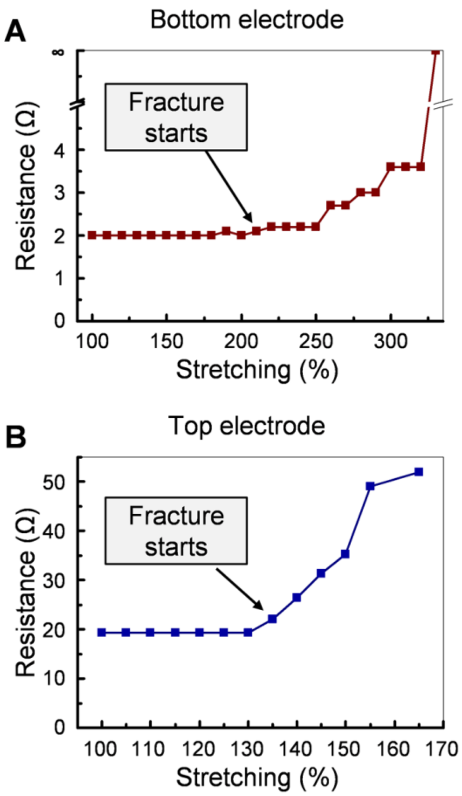

Figure S3. *Electrical resistance testing with stretching. (A) The bottom electrode (2.0-2.2 ohm, Cu meanders, 100 mm wide and 5 mm thick), Electrical resistance remained constant up to 220% stretch. (B) The top electrode (19.0-19.3 ohm, Au meanders, 100 mm wide and 0.25 mm thick), Electrical resistance remained constant up to 130% stretch.*

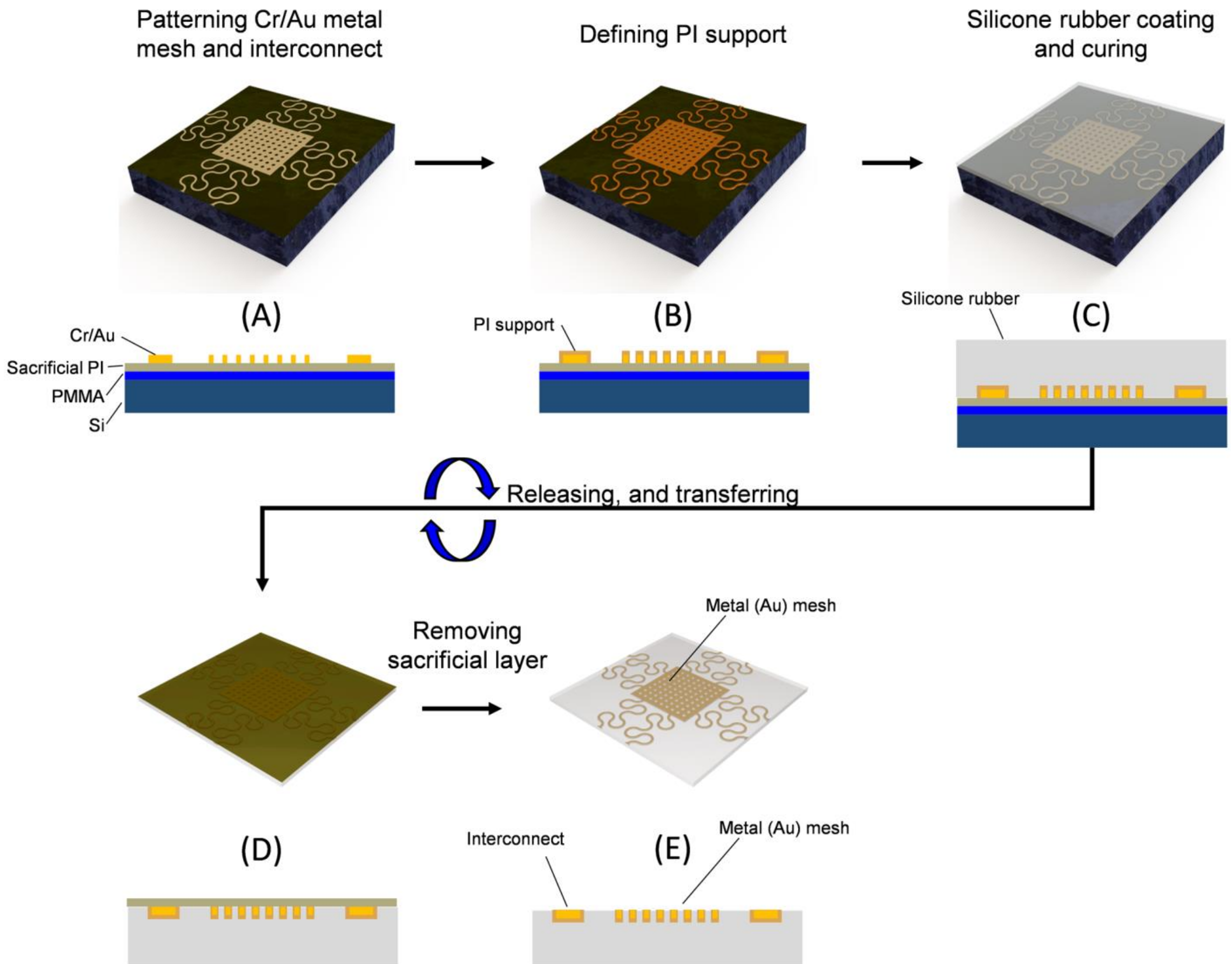

Figure S4. *Fabrication procedure of the top conductive lamination layer. (A) Patterning Cr/Au metal mesh and interconnects. (B) Defining polyimide (PI) support layer. (C) Applying silicone rubber. (D) Releasing and transferring the top conductive layer. (E) Removing the sacrificial PI using a reactive ion etch.*