

Supplementary Information

Graphene superficial layer for advanced electroforming process

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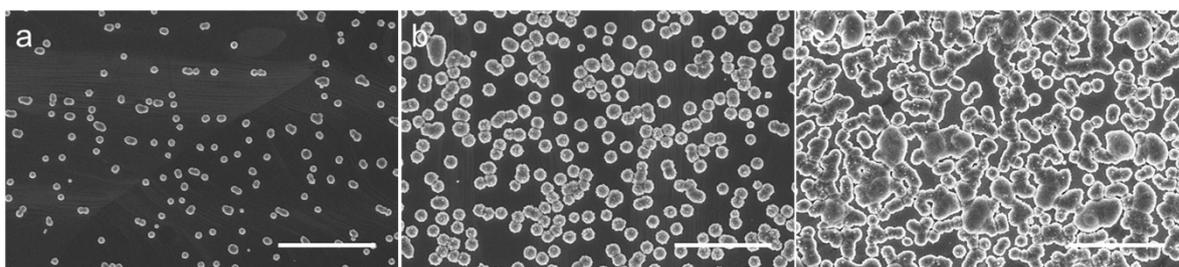


Figure S1. Electroplated Cu nucleation on the surface of graphene/Cu foil substrate. SEM images after deposition for (a) 15s, (b) 30s, and (c) 60s. Scale bar is 10 μm

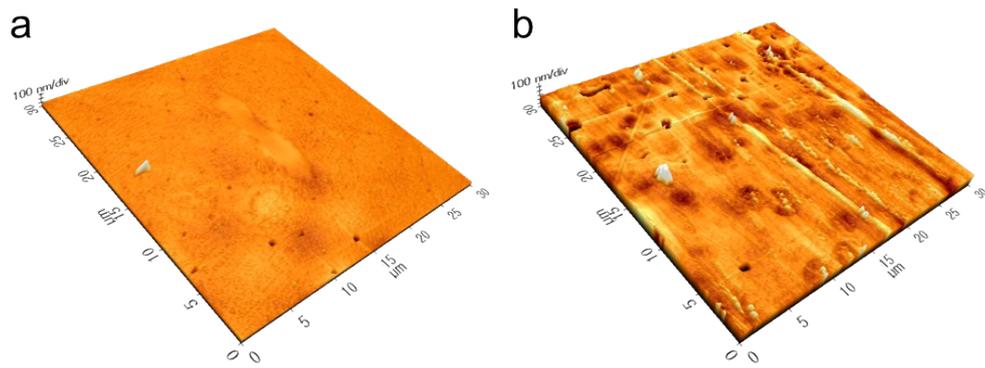


Figure S2. Comparison of the surface morphology of electroformed Cu thin films. AFM images of Cu thin film (contact side with template) (a) graphene/Cu foil and (b) commercial stainless steel. .

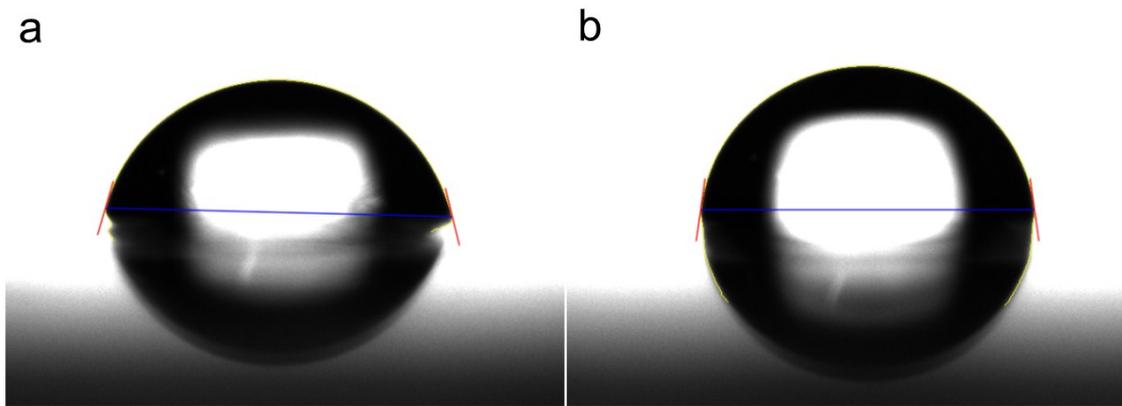


Figure S3. Water contact measurement after exposure in air for 1 day. The photos of water droplet on the surface of (a) graphene/Cu template and (b) electroformed copper.

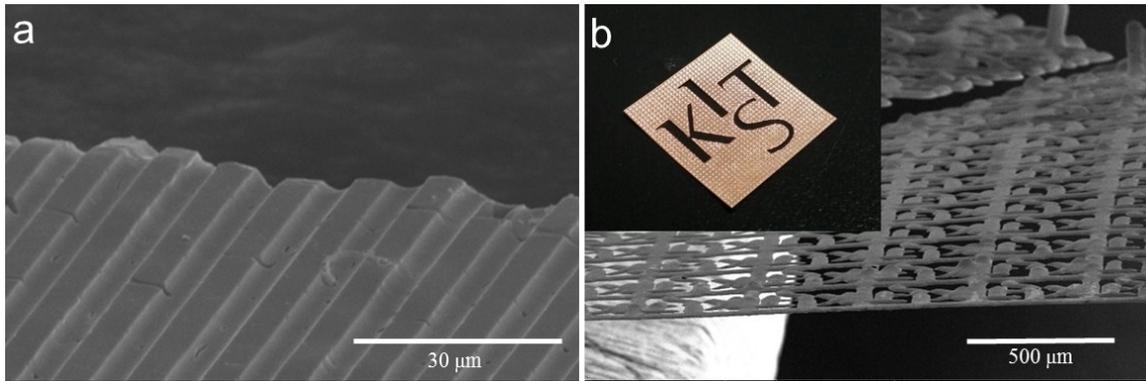


Figure S4. Freestanding electroformed Cu thin film prepared using graphene/Cu template.
(a) 5 μm-line patterned Cu film. (b) The letter “KIST” patterned 30-μm thick Cu film. Inset shows the photo image of the sample with a size of 15 mm x 15 mm.

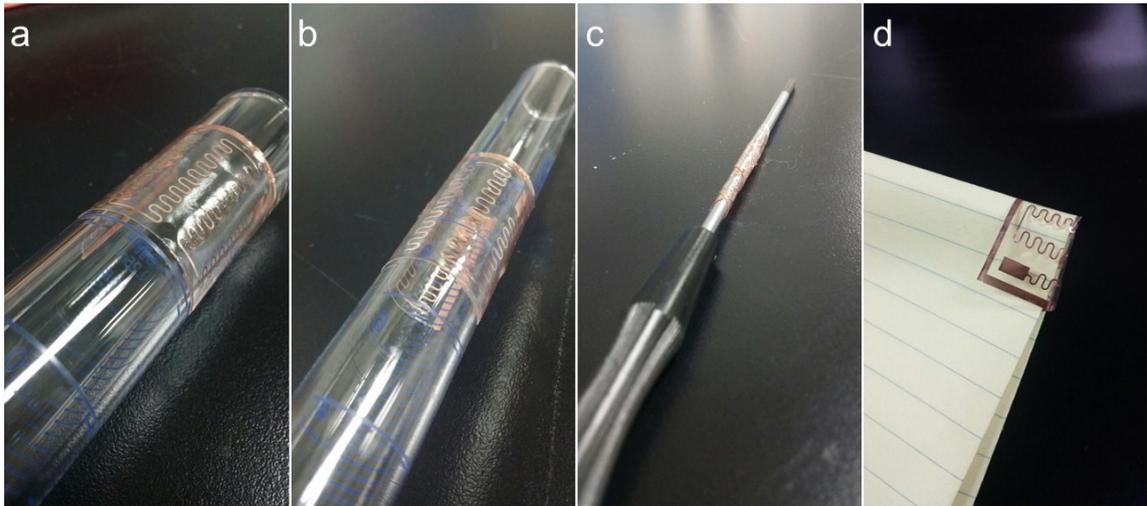


Figure S5. Conductivity test of electroformed Cu line based flexible substrate. The original sheet resistance ($\sim 0.7\Omega/\text{sq}$) was not changed in different bending conditions: bending radius of (a) 10 mm, (b) 7.5 mm, (c) 1 mm and (d) folding on the paper.