Supplementary Information

Extremely Flexible, Printable Ag Conductive Features on PET and Paper Substrate *via* Continuous Milisecond Photonic Sintering in a Large Area

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Figure S1. (a) The variation of photon energies as a function of voltage and duration time, (b) the variation of intensity depending on the applied voltage in the range of 2.0 - 3.0 kV.



Figure S2. The variation of substrate temperatures for (a) PI, (b) Ag nanoparticle coated PI, (c) PET, and (d) Ag nanoparticle coated PET substrates depending on the duration time in the range of 0 - 2.0 msec at different voltages.



Figure S3. Ag 3d spectra for Ag films photo-sintered for different times at 3.0 kV.



Figure S4. TGA data, measured in a ramping rate of 5 °C/min in air, for Ag nanoparticles.



Figure S5. XPS N 1s and O 1s spectra for Ag nanoparticles.



Figure S6. The adhesion tests for Ag nanoparticle films on either PI or PET substrate after photo-sintering process. The Ag nanoparticle layers were photo-sintered on PI and PET for 1 msec at 3.0 kV and for 1.5 msec at 2.0 kV, respectively.



Figure S7. Resistance/resistivity variation for photo-sintered Ag films on PI substrate (a) as a function of bending radius ranging from 1 to 10 mm and (b) under the repeated bending test with a bending radius of 1.5 mm. The photo-sintering was carried out at 3.0 kV for 1.0 msec.



Figure S8. SEM images for photo-sintered Ag films on PET substrate before and after 10,000 times bending test under a bending radius of 1.5 mm. The Ag nanoparticle layers were photo-sintered at 2.0 kV for 1.5 msec.



Figure S9. Top-view SEM images for (a) paper substrate and (b) photo-sintered Ag layer on a paper substrate. The Ag nanoparticle layers were photo-sintered at 2.5 kV for 1.0 msec. Inset shows the cross-sectional image for photo-sintered Ag layers on a paper substrate.

Video S1. Video file for 1000 times repeated bending test under a bending radius of 1.5 mm. Ag films on PET substrate were photo-sintered at 2.0 kV for 1.5 msec. The 1000 times repeated bending test was recorded due to the limited storage capacity for moving pictures in a digital camera, and the video file was created by a 4x playing speed.

Video S2. Video file for 1000 times repeated bending test under a bending radius of 1.5 mm. Ag films on PI substrate were photo-sintered at 3.0 kV for 1.0 msec. The 1000 times repeated bending test was recorded due to the limited storage capacity for moving pictures in a digital camera, and the video file was created by a 4x playing speed.

Video S3. Video file for pen-printed Ag electrodes on a PET substrate.