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ARTICLE TYPE

Electrical functionality of inkjet-printed silver nanoparticle conductive tracks on nanostructured paper compared with those on plastic substrates

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† Electronic Supplementary Information (ESI) available: See DOI: 10.1039/b000000x/

This Supplementary Information includes the following Figures to provide a more detail information on microstructure and XRD patterns of inkjet-printed AgNP conductive tracks on nanostructured paper, PI, and PEN-Q83 after curing at 150°C for 10, 30, and 60 min.

Fig. S1. FE-SEM images of inkjet-printed silver nanoparticle conductive tracks on nanostructured paper, PI, and PEN-Q83 after cuting at 150°C for 10, 30 and 60 min.

Fig. S2. High magnification (×100,000) FE-SEM images of ink-jet printed silver nanoparticle conductive tracks on nanostructured paper , PI, and PEN-Q83 after curing at 150°C for 10 min and 60 min

Fig. S3. XRD patterns of inkjet-printed silver nanoparticle conductive tracks after curing at 150°C for 10, 30, and 60 min. (a) on nanostructured paper, (b) on PI, and (c) on PEN-Q83.

Experimental

Samples for FE-SEM imaging were sputtered-coated with gold by an ion sputter coater (E-1045, Hitachi High-Tech Science Corp., Japan) and imaged at 1.5 kV by a field emission scanning electron microscope (FE-SEM, JSM-6700F, JEOL td., Japan)

For XRD measurement, the AgNP conductive tracks with 2 mm width were ink-jet printed with 3 layers on top of each other at room temperature. The printed features were subsequently cured by placing them on a hot plate set at 150°C in air for 10, 30, and 60 min interval.

The XRD patterns were recorded using Rigaku RINT-2500 diffractometer (Cu Kα: 40 kV-30 mA) (Rigaku Corp., Japan). All the measurements were carried out at ambient temperature. X-ray diffraction intensities were collected for 10 min at 0.045° intervals over the 2θ range of 20 to 140°.

The presence of strong peaks at 2θ values 28.205°, 44.325°, 64.485°-64.53°, 77.5°, 81.5°, 110.47°, 114.88° corresponds to (111), (200), (220), (311), (222), (331), and (420) planes of pure silver metal, respectively (JCPDS, File No. 4-0783)

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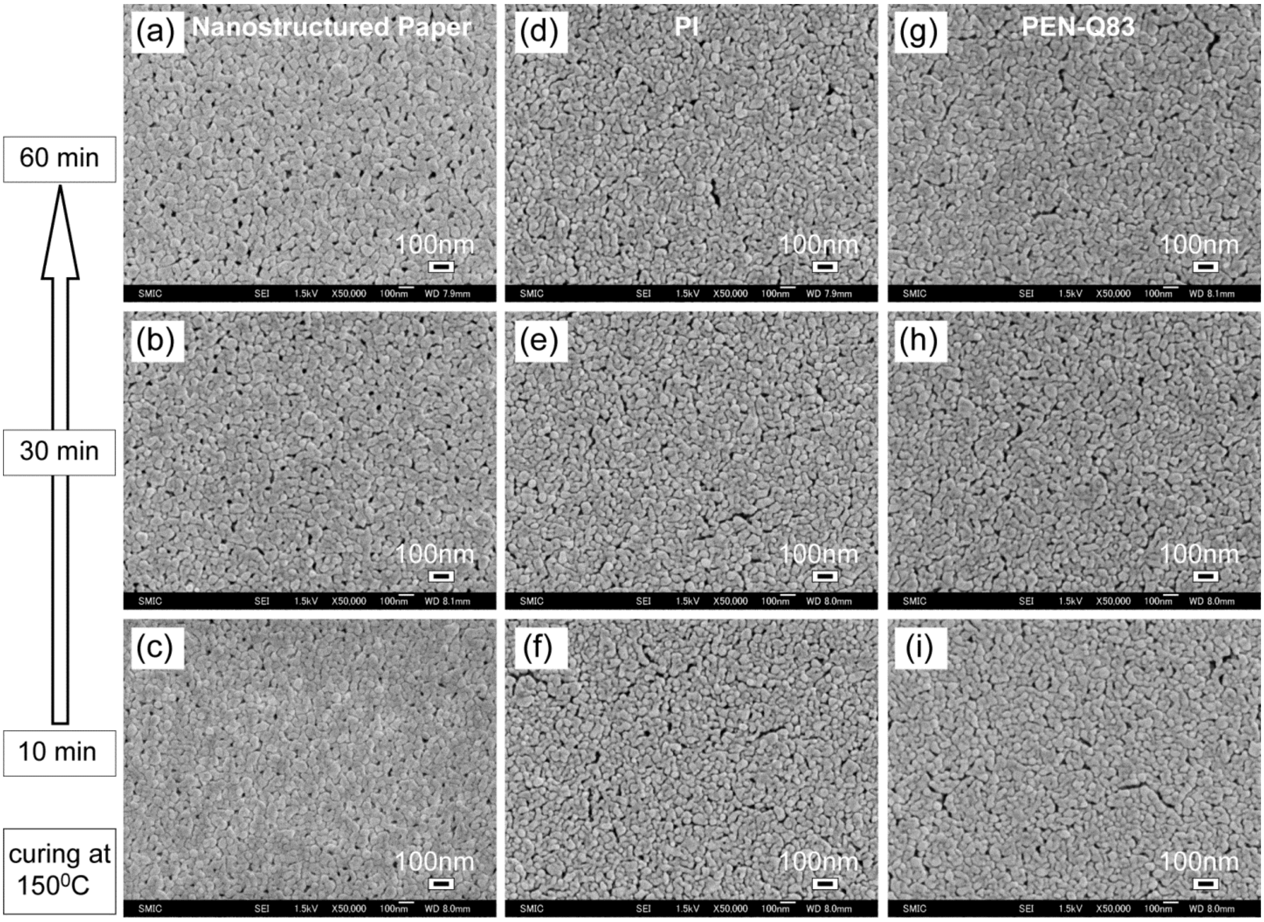

Fig.S1. FE-SEM images of inkjet-printed silver nanoparticles conductive tracks (a-c) on nanostructured paper, (d-f) on PI, and (g-i) on PEN-Q83 after curing at 150°C for (c, f, i) 10 min, (b, e, h) 30 min, and (a, d, g) 60 min. The AgNP s make good contact with each other to form a closely packed conductive layer with a few discrete voids on nanostructured paper (a-c), whereas interparticle necking with relatively narrow and longer voids occurred on PI (d-f) and PEN-Q83 (g-i). The discrete voids on the nanostructured paper confirmed the liquid absorption process through nanopores, while the presence of liquid vehicle on the non-porous, non-permeable plastic substrates has left narrow and longer voids resulting from interparticle necking and liquid evaporation.

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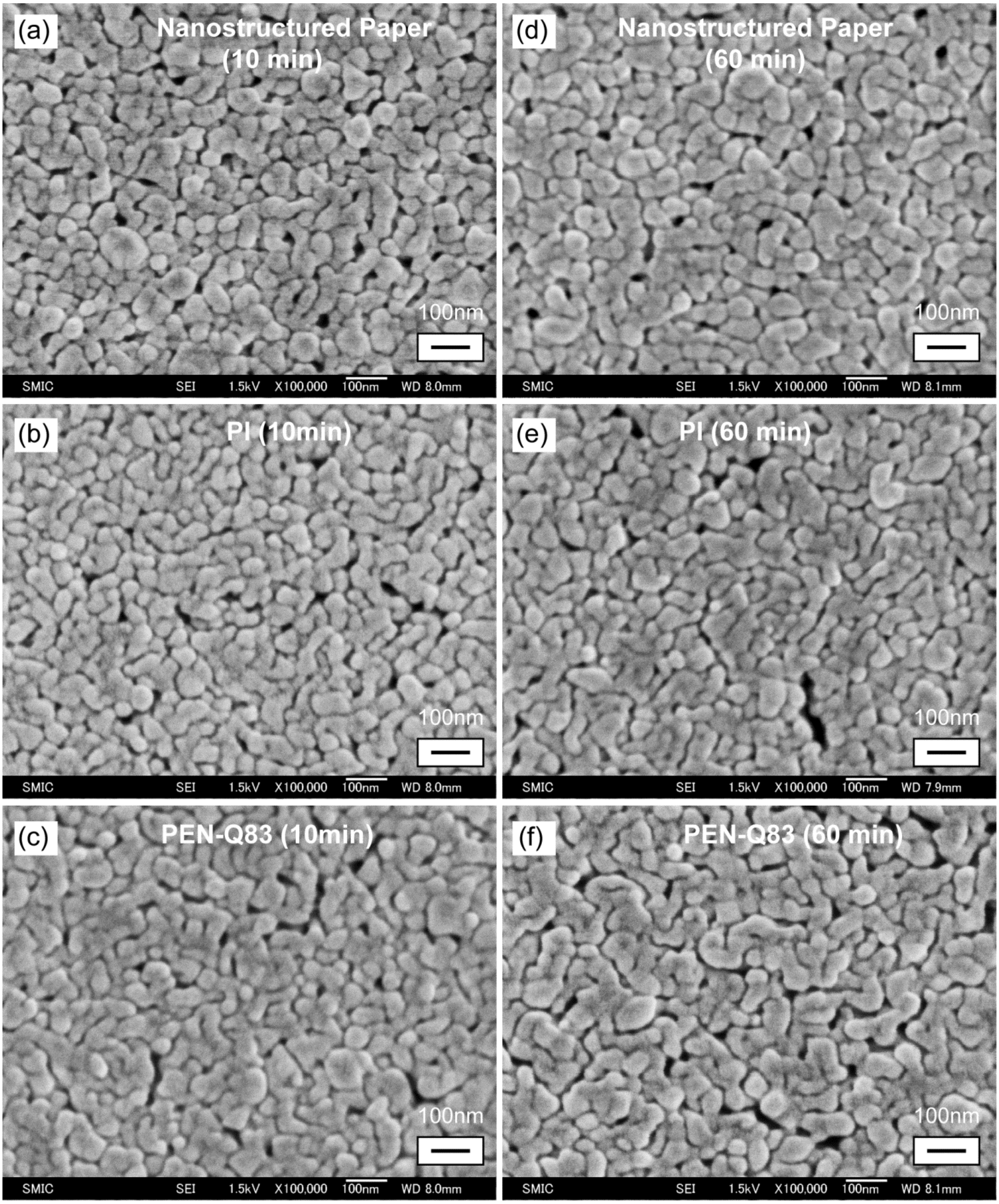

Fig. S2. High magnification (×100,000) FE-SEM images of inkjet-printed silver nanoparticle conductive tracks (a, d) on nanostructured paper, (b, e) PI, and (c, f) PEN-Q83 after curing at 150°C for (a-c) 10min and (d-f) 60min. Only a slight difference in particle size was observed on nanostructured paper from 10 min (a) to 60 min (d) curing time with same microstructure, whereas continuation of interparticle necking with a relatively larger particle size was observed on PI (e) and PEN-Q83 (f) for 60 min curing time than those for 10 min curing time (b, c).

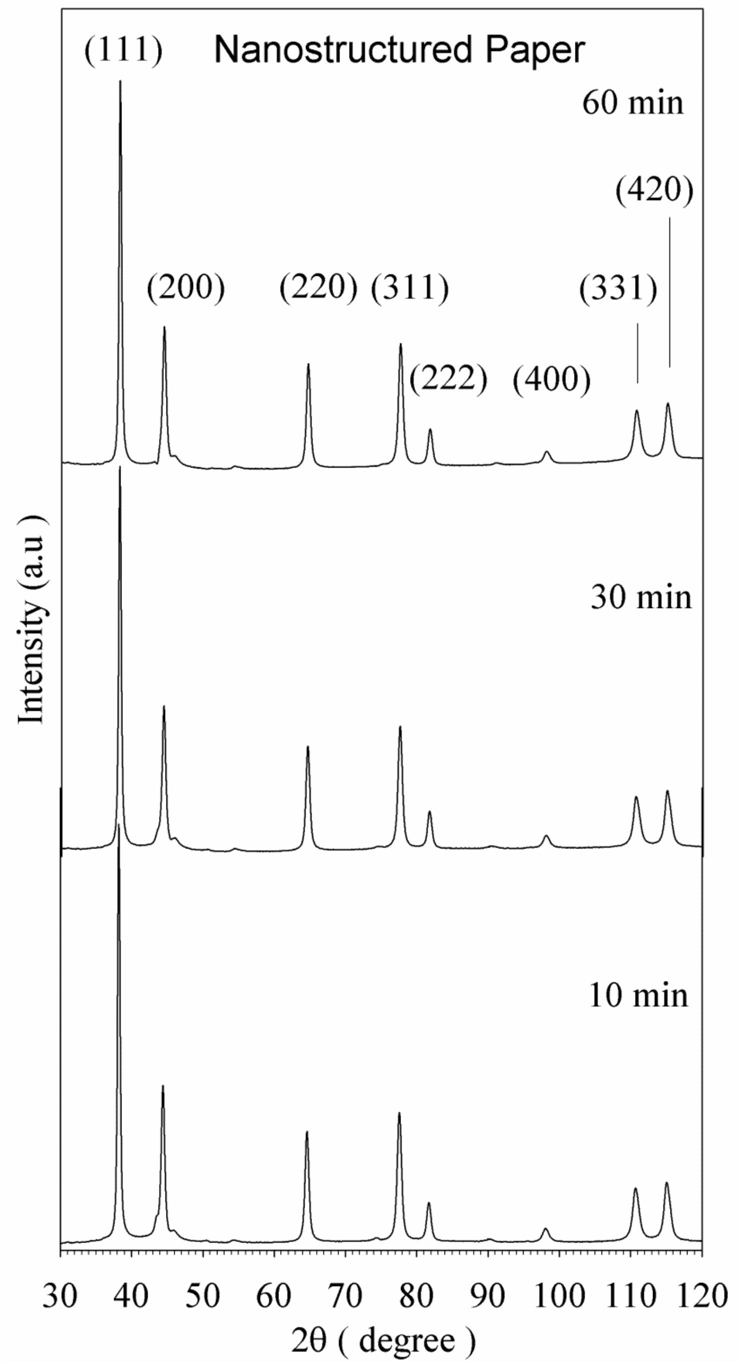

Fig. S3(a) XRD patterns of inkjet-printed silver nanoparticle conductive tracks on nanostructured paper after curing at 150°C for 10, 30, and 60 min. A number of strong Bragg reflections- (111), (200), (220), (311), (222), (311), and (420) confirmed the crystalline structure of silver nanoparticles.

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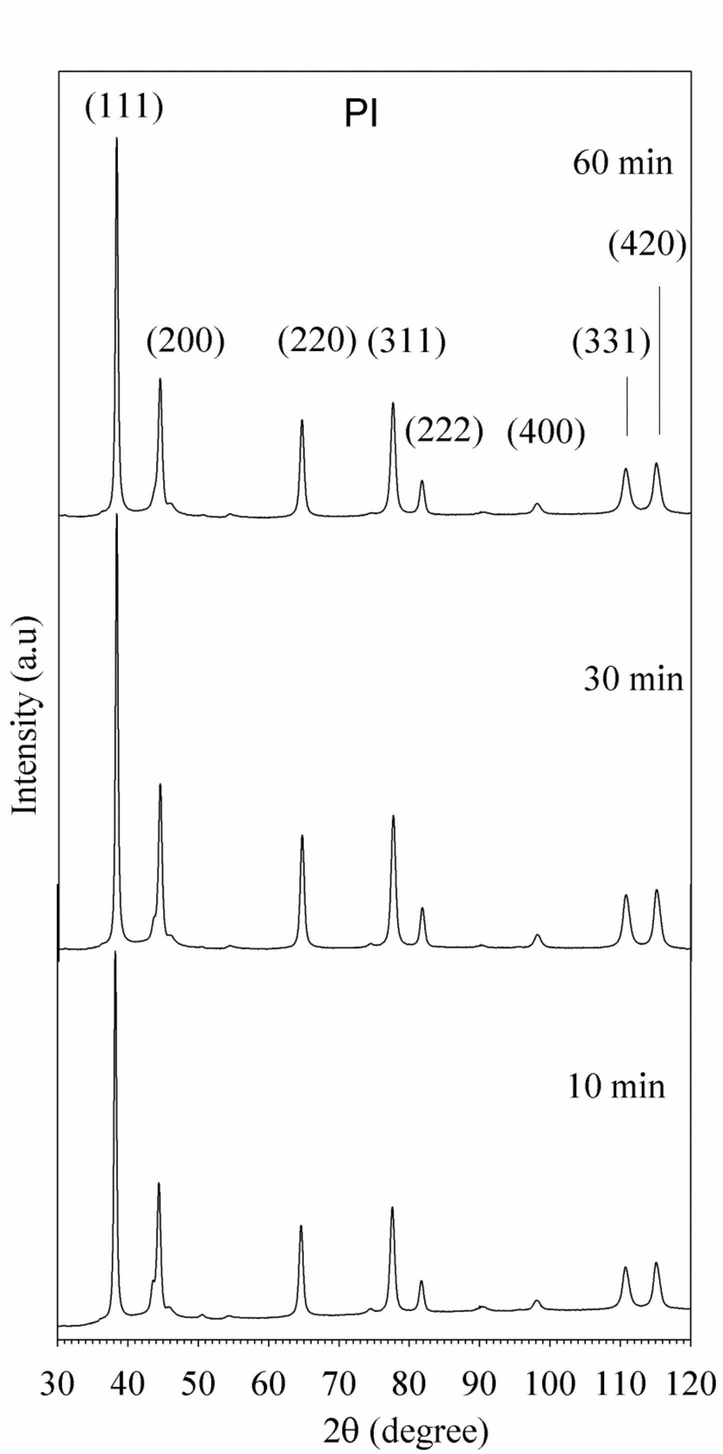

Fig. S3(b) XRD patterns of inkjet-printed silver nanoparticle conductive tracks on PI after curing at 150°C for 10, 30, and 60 min. A number of strong Bragg reflections- (111), (200), (220), (311), (222), (311), and (420) confirmed the crystalline structure of silver nanoparticles.

Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C

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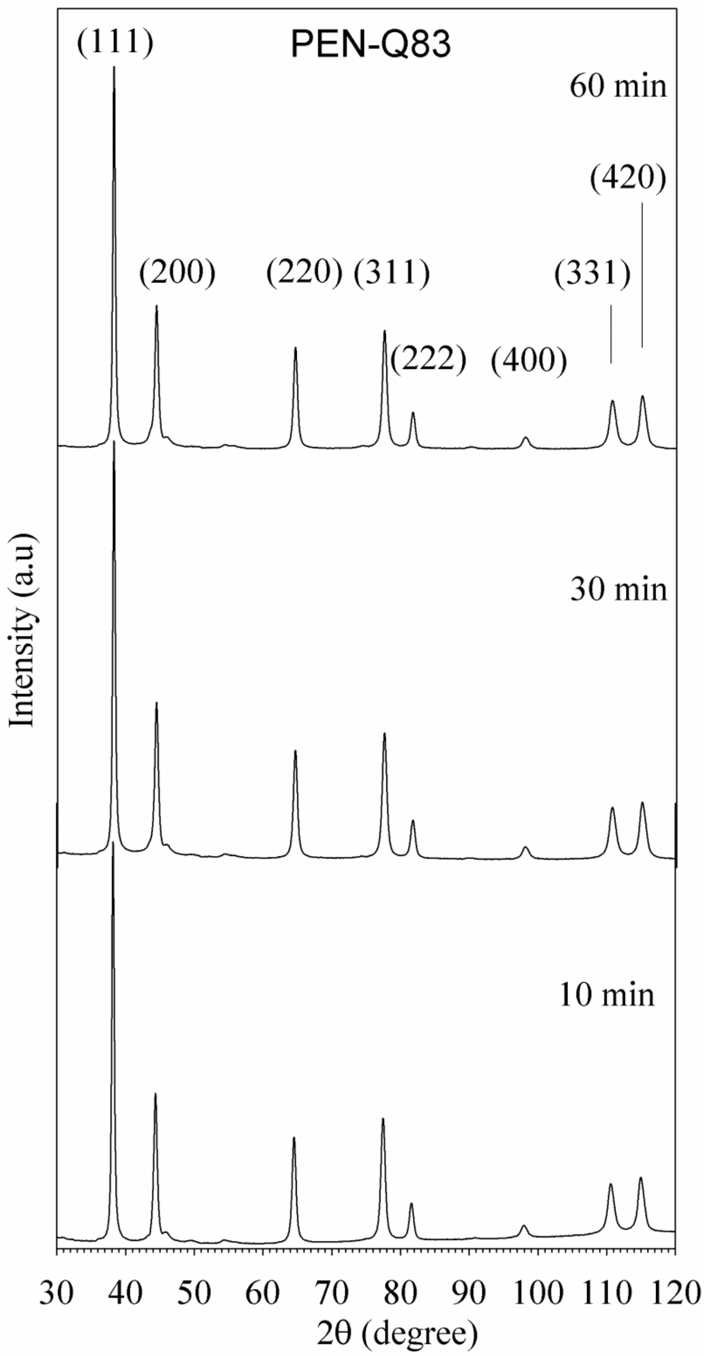

Fig. S3(c) XRD patterns of inkjet-printed silver nanoparticle conductive tracks on PEN-Q83 after curing at 150°C for 10, 30, and 60 min. A number of strong Bragg reflections- (111), (200), (220), (311), (222), (311), and (420) confirmed the crystalline structure of silver nanoparticles.