Electronic Supplementary Information for

Fabrication of high performance / highly functional field-effect transistor devices based on [6]phenacene thin films

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Surface morphology of [6]phenacene thin films on SiO_2/Si and parylene/Au/PET substrates

The surface morphology and the size of crystallite were investigated by the atomic force microscope (AFM) and the x-ray diffraction (XRD) measurements. AFM image and XRD pattern were measured with AFM measurement system (SII Nano Technology SPA400) and x-ray diffractometer (Rigaku Smartlab-pro), respectively.

Figure S1 shows the AFM images of [6]phenacene thin film formed on SiO_2/Si (Fig. S1(a)) and parylene/Au/PET (Fig. S1(b)). The AFM image shows the closely packed granules. Each granule on SiO_2/Si has the size as large as 500 nm, while that on parylene/Au/PET has the size as large as 100 nm. The root mean square (RMS) roughness in thin films is 5.6 nm on SiO_2/Si and 9.1 nm on parylene/Au/PET, showing the flat surface as in picene and [7]phenacene: 3.1 nm for picene[1] and 4.8 nm for [7]phenacene.[2]

X-ray diffraction patterns of [6]phenacene thin films formed on SiO_2/Si and parylene/Au/PET are shown in Figs. S2(a) and S2(b), respectively. Both diffraction pattern show only 00*l* reflections in the same manner as picene and [7]phenacene, implying that *ab*-plane (*ab*-layer) in [6]phenacene thin films are parallel grown on the substrate surface.[3] The distance between layers substantially corresponds to the lattice constant *c*, which is estimated to be 15.58(1) Å for SiO_2/Si and 15.49(2) Å for parylene/Au/PET from the 00*l* reflections. As shown in previous report, it can be assumed that [6]phenacene crystals take herringbone structure as in picene. The sizes of crystallite are estimated to be 56(9) nm for SiO_2/Si and 49(6) nm for parylene/Au/PET from the full width at half maximum (FWHM) for

diffraction peaks with Scherrer formula.

From the point of view of granule size, surface roughness and crystallite size, [6]phenacene thin film on SiO_2/Si shows better crystallinity that has the large granule and the flat surface, resulting in high performance FET characteristics in [6]phenacene thin film FET on SiO_2/Si.

References

1 Y. Kaji, N. Kawasaki, X. Lee, H. Okamoto, Y. Sugawara, S. Oikawa, A. Ito, H. Okazaki, T. Yokoya, A. Fujiwara and Y. Kubozono, *Appl. Phys. Lett.* 2009, **95**, 183302.

2 Y. Sugawara, Y. Kaji, K. Ogawa, R. Eguchi, S. Oikawa, H. Gohda, A. Fujiwara, Y. Kubozono, *Appl. Phys. Lett.* 2011, **98**, 013303.

3 N. Komura, H. Goto, X. He, H. Mitamura, R. Eguchi, Y. Kaji, H. Okamoto, Y. Sugawara, S. Gohda, K. Sato and Y. Kubozono, *Appl. Phys. Lett.* 2012, **101**, 083301.

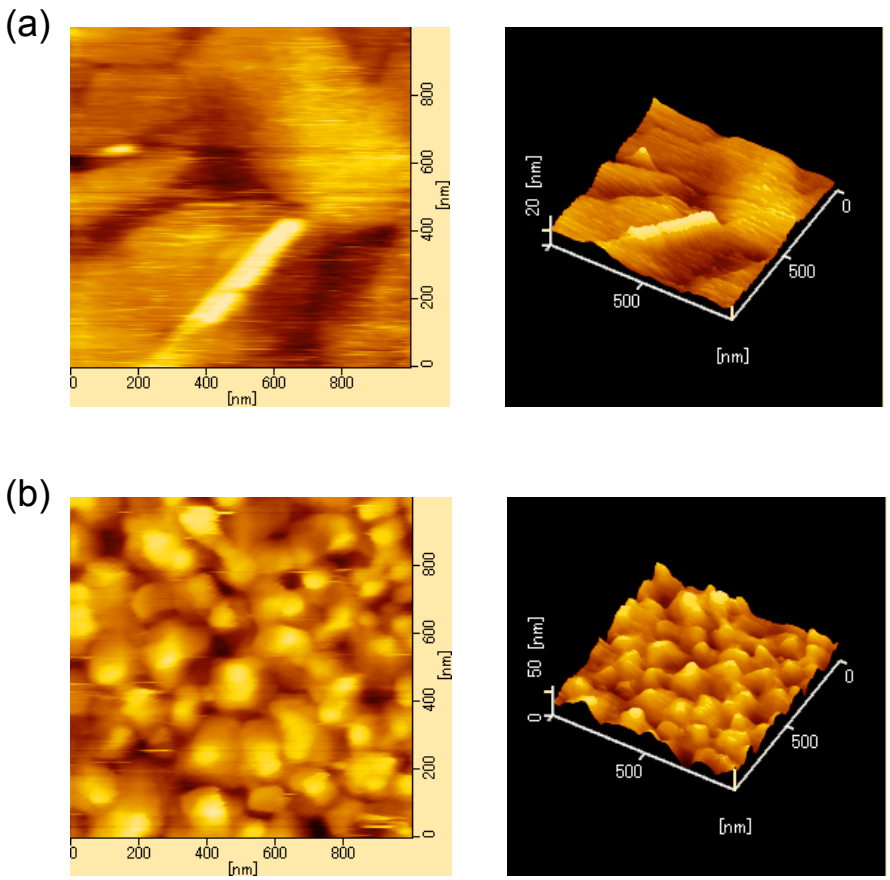

Fig. S1. AFM images of [6]phenacene thin film formed on (a) SiO_2/Si and (b) parylene/Au/PET.

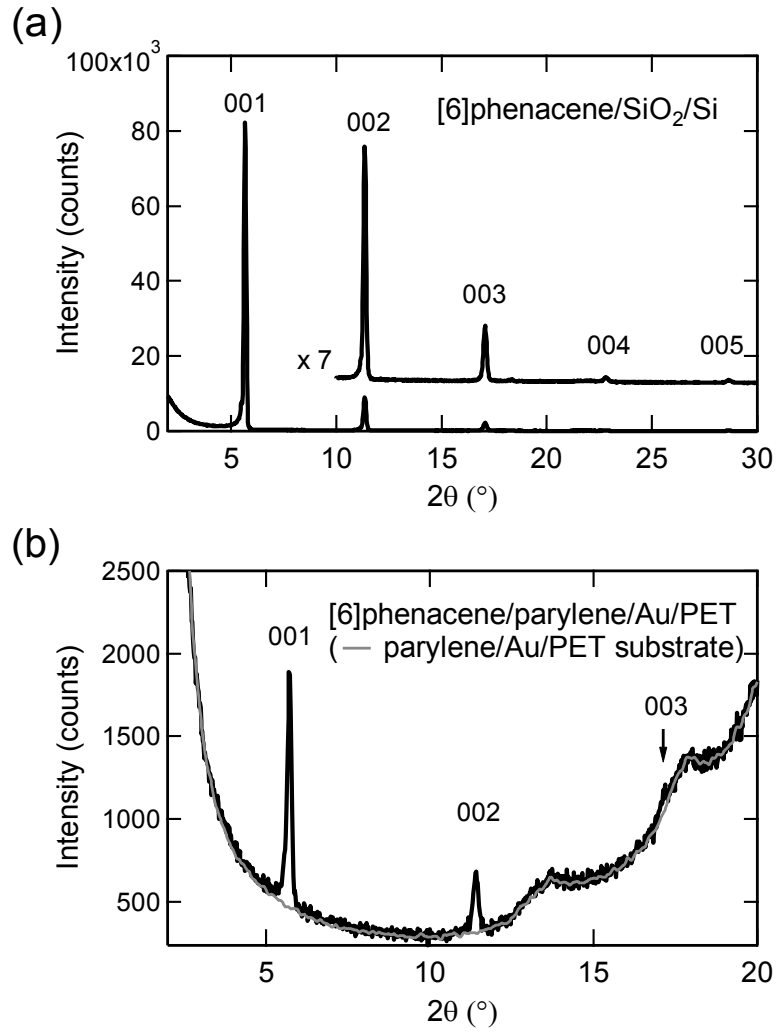

Fig. S2. X-ray diffraction patterns of [6]phenacene thin films formed on (a) SiO_2/Si and (b) parylene/Au/PET.