Electronic Supplementary Information (ESI)

Mechanically rollable photodetectors enabled by centimetre-scale 2D MoS₂ layer/TOCN composites

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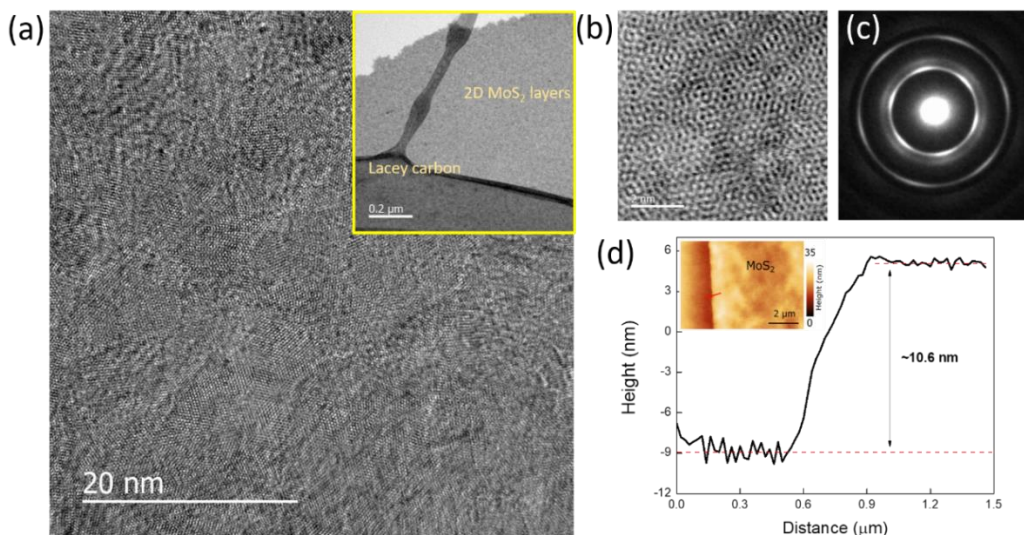[*] Corresponding author; yeonwoong.jung@ucf.edu

Fig. S1 (a) Low-magnification transmission TEM image of CVD-2D MoS$_2$ layers. The inset image confirms the continuous morphology of the sample. (b) High-resolution TEM (HRTEM) image of the same sample showing Moiré fringes, indicative of vertically-stacked individual 2D layers. (c) Selective area electron diffraction (SAED) pattern obtained from the sample area corresponding to the inset image in (a). (d) AFM height profile obtained from CVD-2D MoS$_2$ layers grown with Mo of 3 nm thickness.
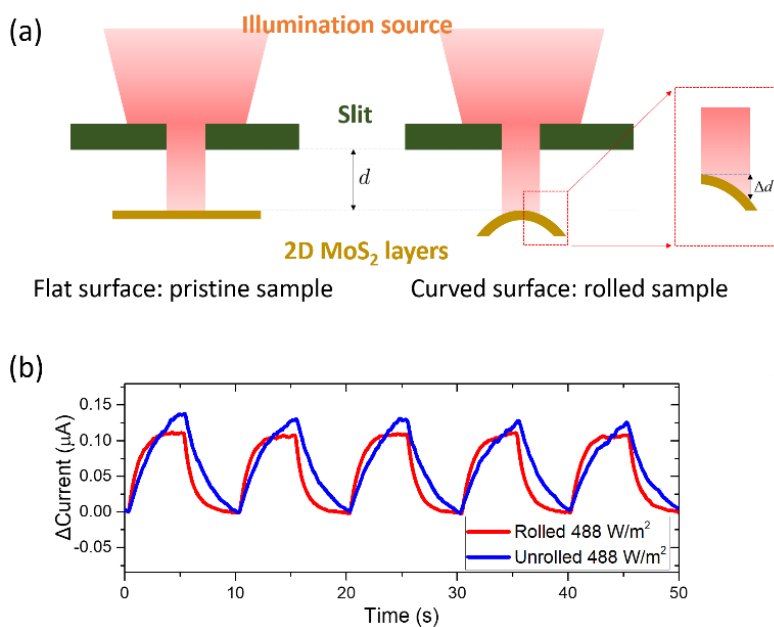

Fig. S2 (a) Schematic illustrations of the experimental set-ups for photocurrent measurements in unrolled vs. rolled states. An identical sample is illuminated through a slit to ensure an identical illumination area. The rolled sample must exhibit a large variation of the illumination distance, Δd, which becomes larger with increasing the bending curvature. (b) Photo-responsive characteristics from a sample in two distinct states of rolled vs. unrolled, corresponding to the measurement schematics in (a).
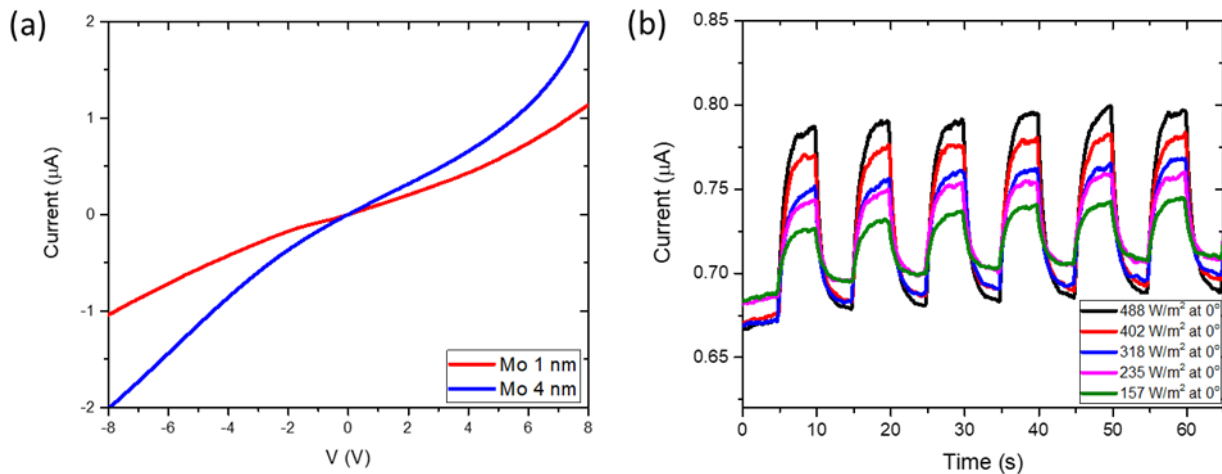
Fig. S3 (a) Two-terminal I-V characteristics of two different MoS_2/TOCN samples prepared with Mo seed of 1 and 4 nm thickness. (b) Time-dependent current variation from a rolled MoS_2/TOCN sample prepared with Mo of 4 nm thickness under a periodic LED illumination.
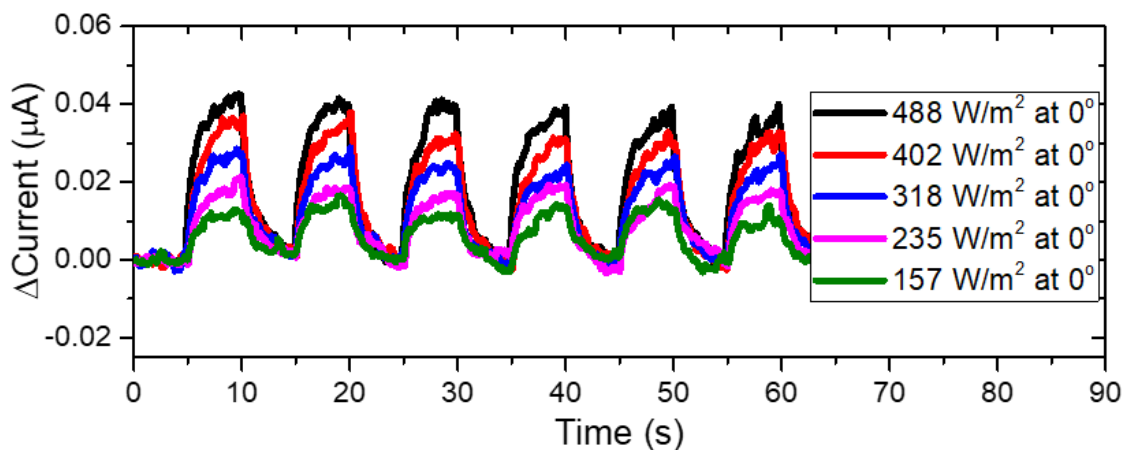

Fig. S4 Time-dependent photocurrents from another sample under a periodic illumination with varying illumination intensities for Mo 1 nm sample which shows linear increase respect to the optical power.
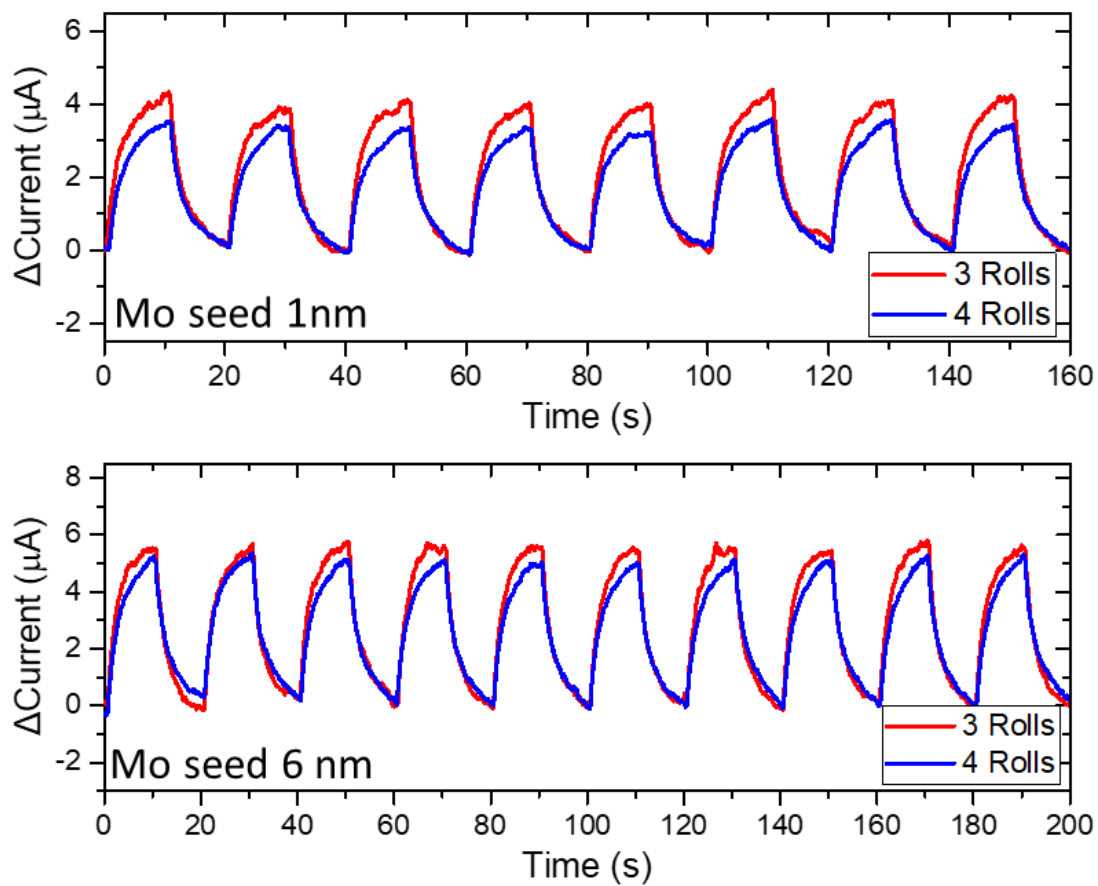
Fig. S5 Time- and rolling number-dependent photocurrents obtained from MoS$_2$/TOCN samples prepared with Mo of 1 and 6 nm thickness under a periodic LED illumination measured at 5 V.
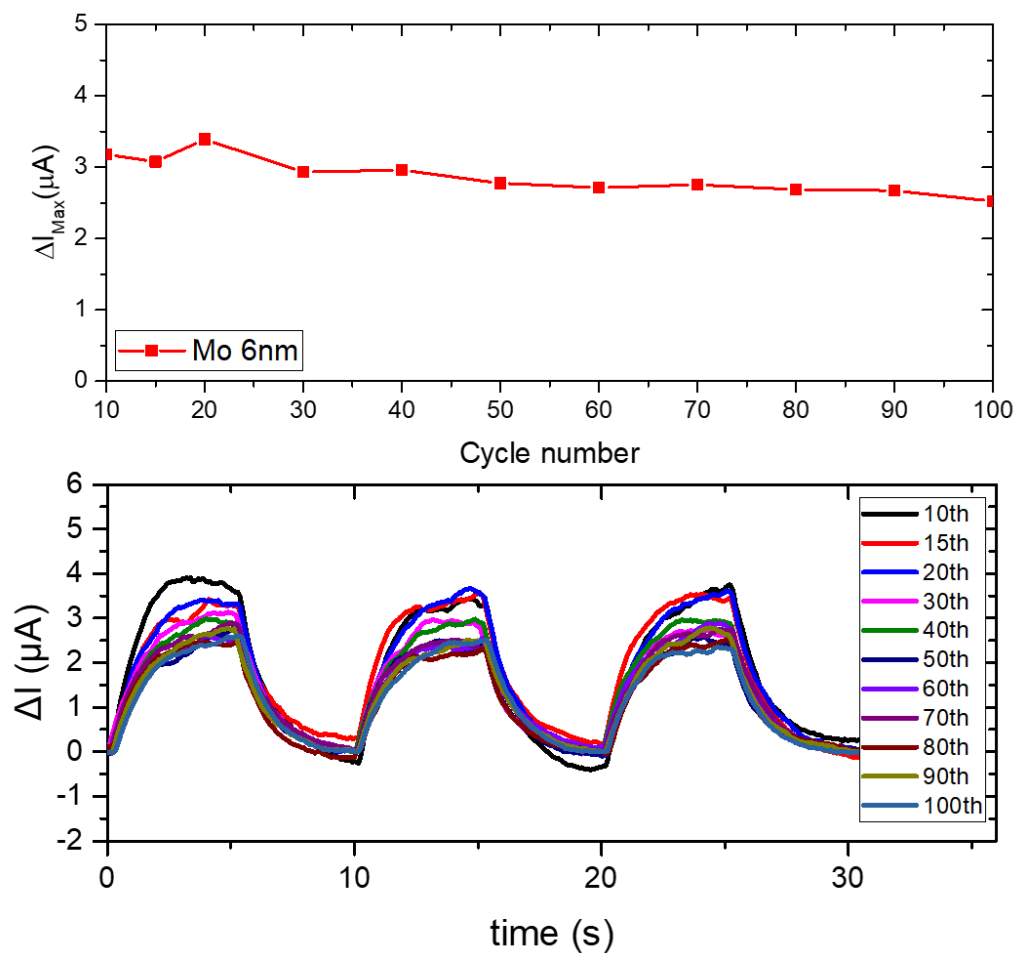
Fig. S6 (a) Average ΔI_{Max} ($I_{Photo,Max} - I_o$) obtained from Mo 6 nm sample as shown in Fig. 5, during the cyclic unrolling/rolling of 100 times at 5 V. (b) Time-dependent photocurrents corresponding to (a) during 5 s on/off when 625 nm LED illumination intensity was 488 W/m^2.
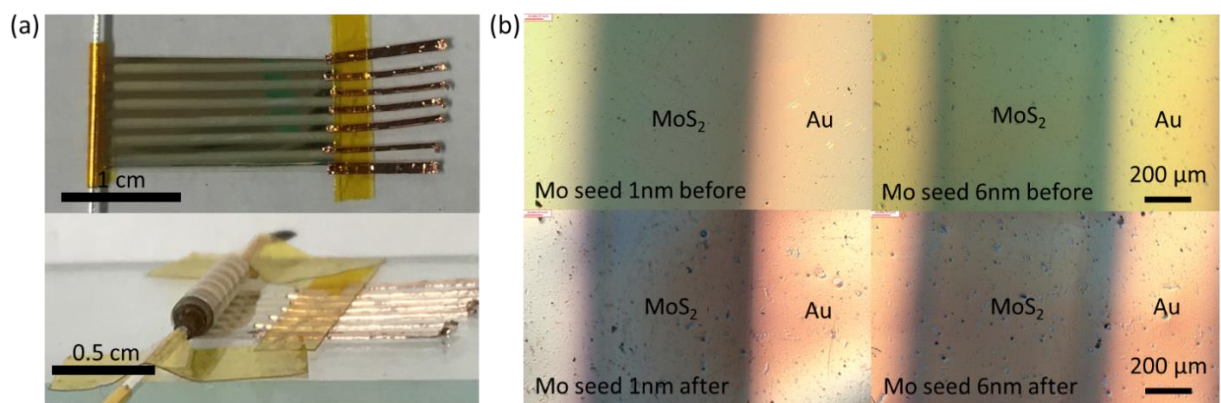

Fig. S7 (a) MoS$_2$/TOCN before (top) and after (bottom) a tight rolling. (b) Optical microscope images before (top) and after (bottom) the rolling.