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

Supporting Information

Rapid, One-Pot Synthesis of Luminescent MoS_2 Nanoscrolls Using Supercritical Fluid Processing

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I. Structural characterization:

XRD data was acquired using a PAN Analytical X' pert PRO Model X-ray Diffractometer with Cu Kα radiation (α = 1.5418 Å) from 10-80° at 0.02° step and a count time of 0.2s. Raman spectra were recorded using laser Raman system (RENISHAW Invia laser Raman microscope) equipped with a semiconducting laser with a wavelength of 633 nm. The surface morphology of bulk MoS_2 and MoS_2 nanoscrolls were characterized by field emission scanning electron microscopy (FE-SEM) using Carl Zeiss AG (Supra 55VP) with an acceleration voltage of 5–30 kV. Transmission electron microscopy (TEM) and High Resolution Transmission Electron Microscopy (HR-TEM) images of bulk MoS_2 and exfoliated MoS_2 nanoscrolls were conducted by Tecnai G^2 20 and Tecnai G^2 F20 S-Twin working at an accelerating voltage of 200 kV, respectively. Thickness of MoS_2 nanoscrolls were measured by non-contact mode in atomic force microscopy (AFM) using an Agilent model 5500. UV-Visible absorption spectra were recorded using Agilent 8453 UV-visible spectroscopy system. Photoluminescence (PL) emission and excitation spectra of MoS_2 nanoscrolls were recorded using a spectrofluorometer (FP8500, JASCO). The UV-visible and photoluminescence measurements were carried out after calibration with the respective standards.

Morphological characterization of bulk MoS_2 powder and exfoliated MoS_2 nanoscrolls:

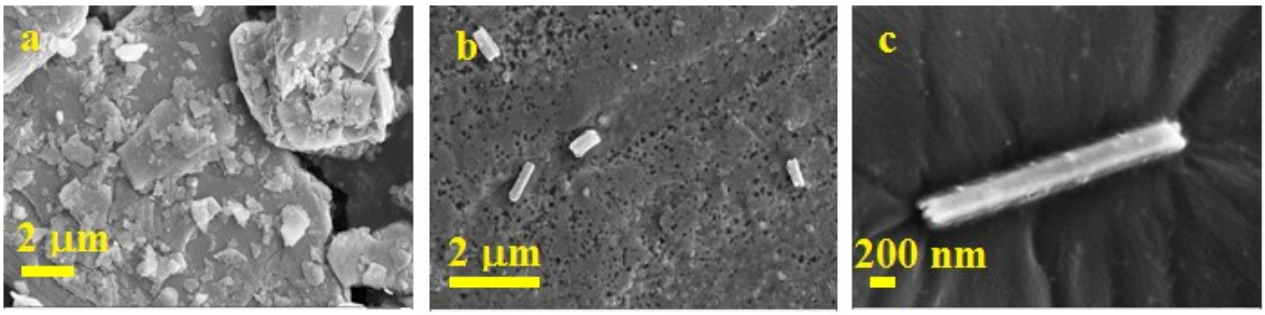


Fig S1. FE-SEM images of (a) bulk MoS_2 powder and (b&c) MoS_2 nanoscrolls

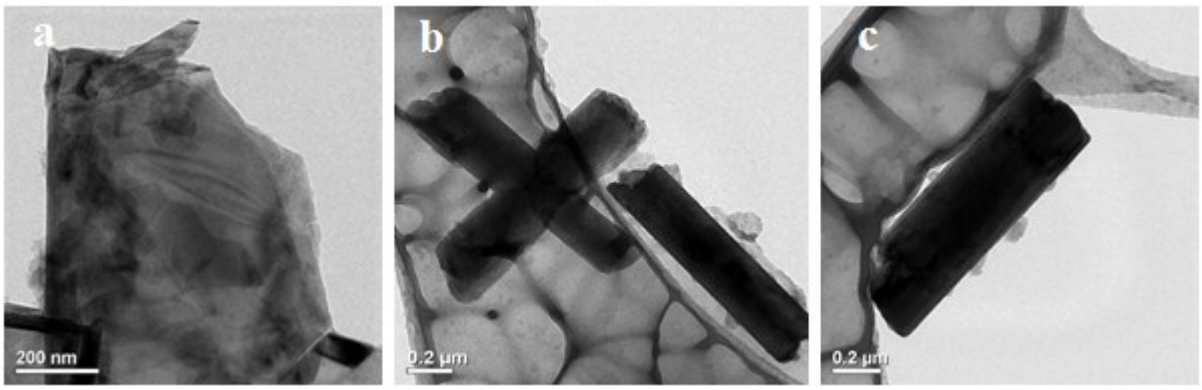
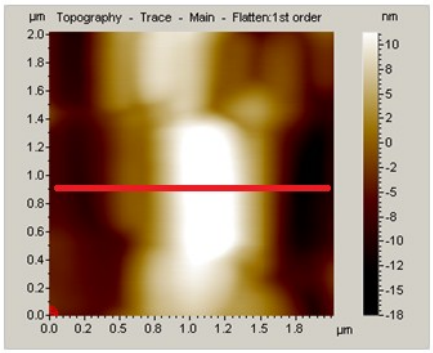
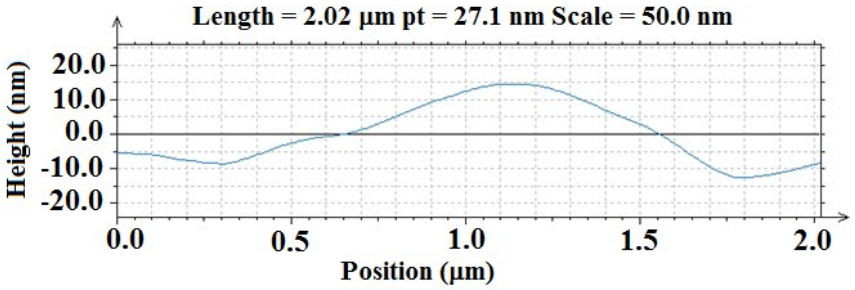
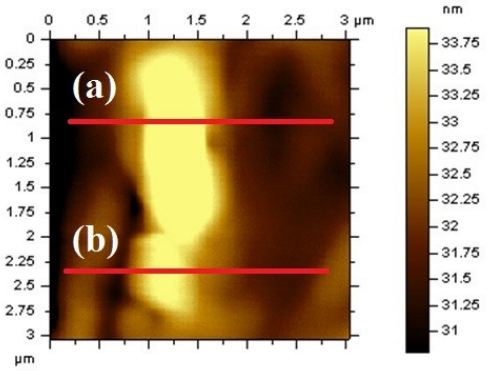
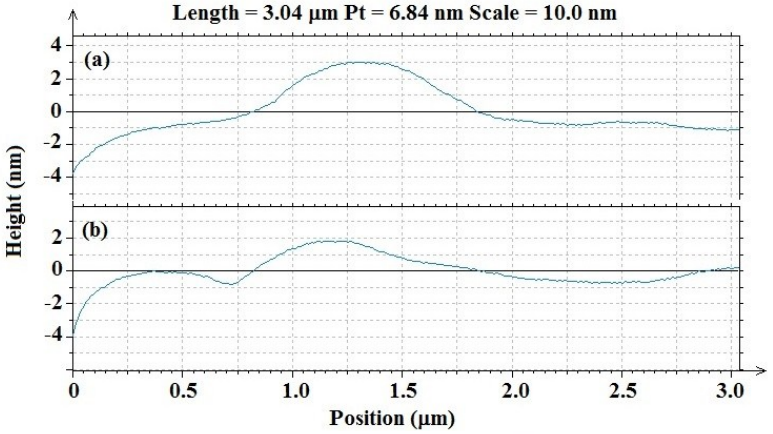


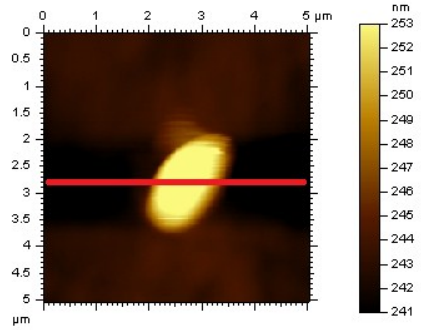
Fig S2. TEM images of (a) bulk MoS_2 powder and (b&c) MoS_2 nanoscrolls

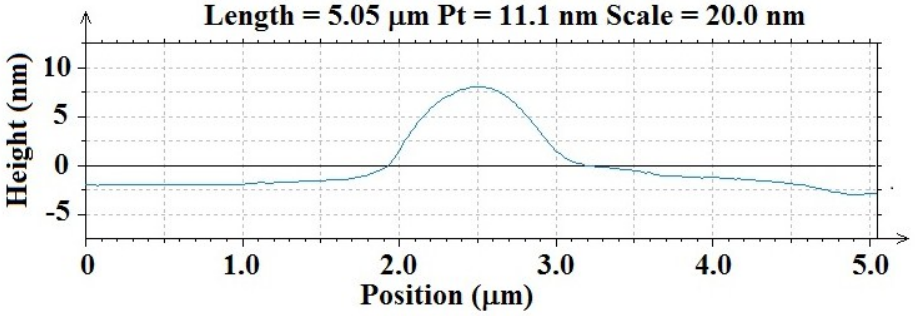

µm Topography - Trace - Main - Flatten:1st order
nm
µm

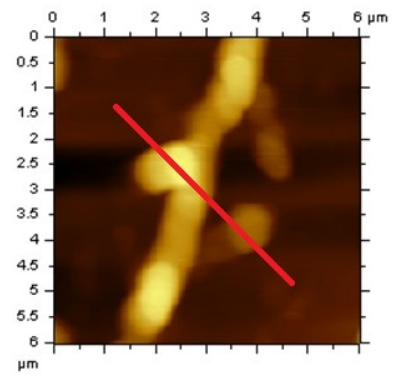

Length = 2.02 µm pt = 27.1 nm Scale = 50.0 nm
Height (nm)
Position (µm)

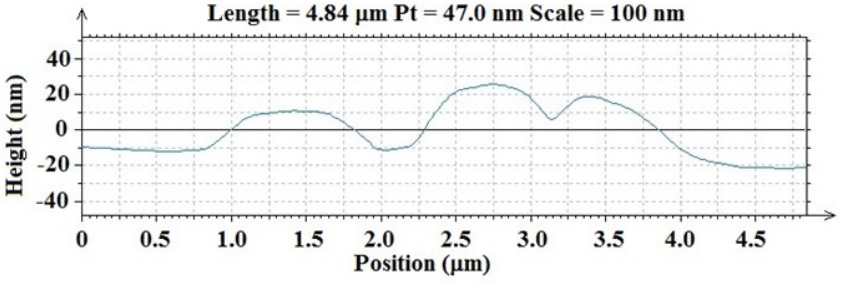

(a)
(b)
nm
µm


Length = 3.04 µm Pt = 6.84 nm Scale = 10.0 nm
(a)
(b)
Height (nm)
Position (µm)


nm
µm


Length = 5.05 µm Pt = 11.1 nm Scale = 20.0 nm
Height (nm)
Position (µm)


nm
µm


Length = 4.84 µm Pt = 47.0 nm Scale = 100 nm
Height (nm)
Position (µm)

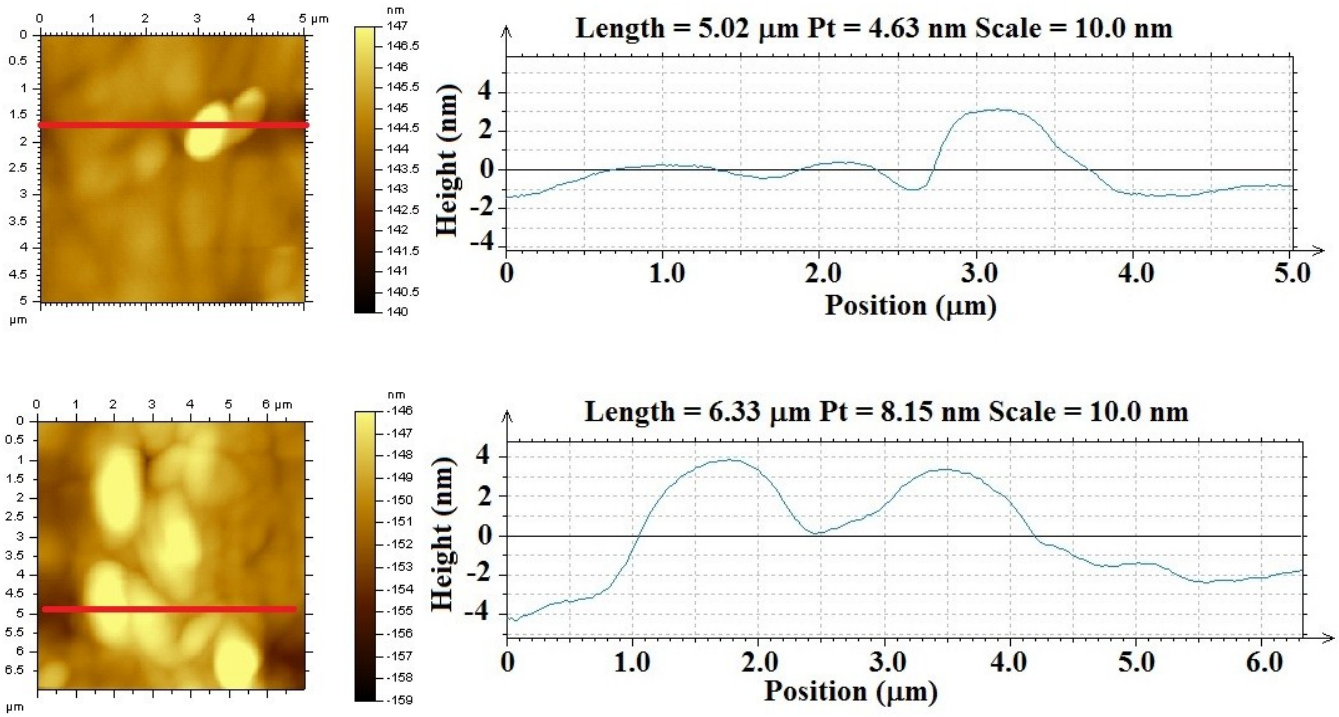


Fig S3. AFM images and corresponding height profile of exfoliated MoS_2 nanoscrolls on silica substrate.

UV Visible absorption spectra:

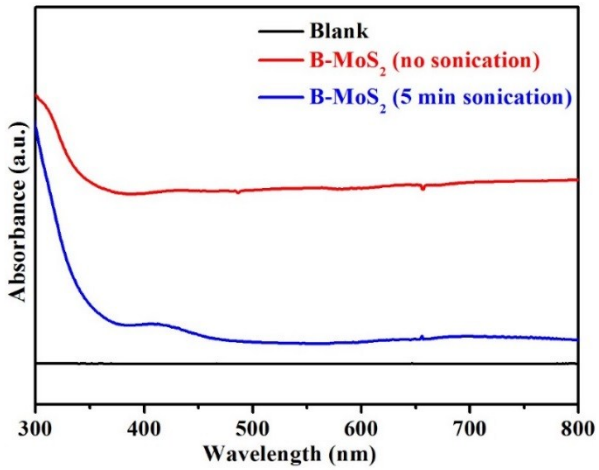


Fig S4. UV-Visible absorption of blank (DMF) solution and bulk MoS_2 (B-MoS_2).

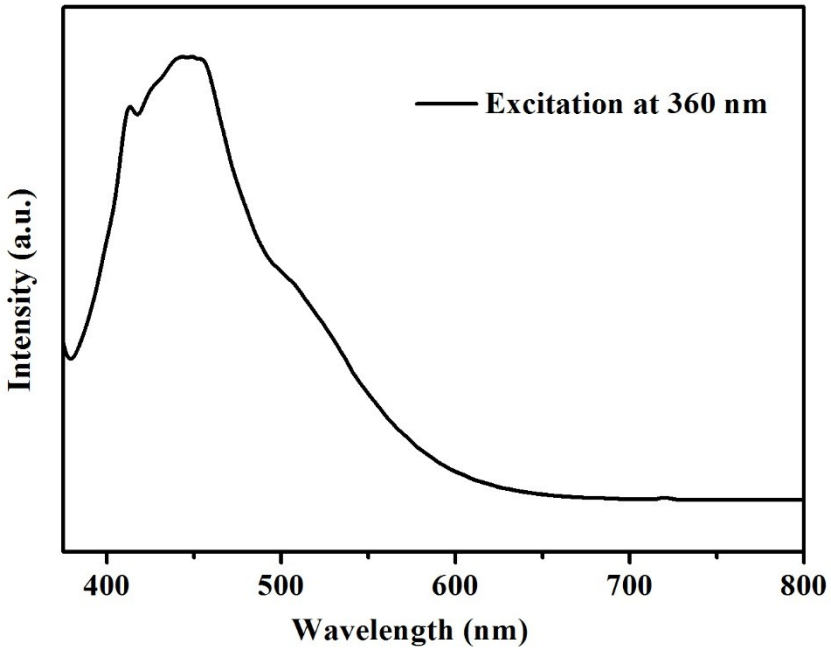


Fig S5. Emission spectrum of exfoliated MoS_2 nanoscrolls in water (excitation at 360 nm)

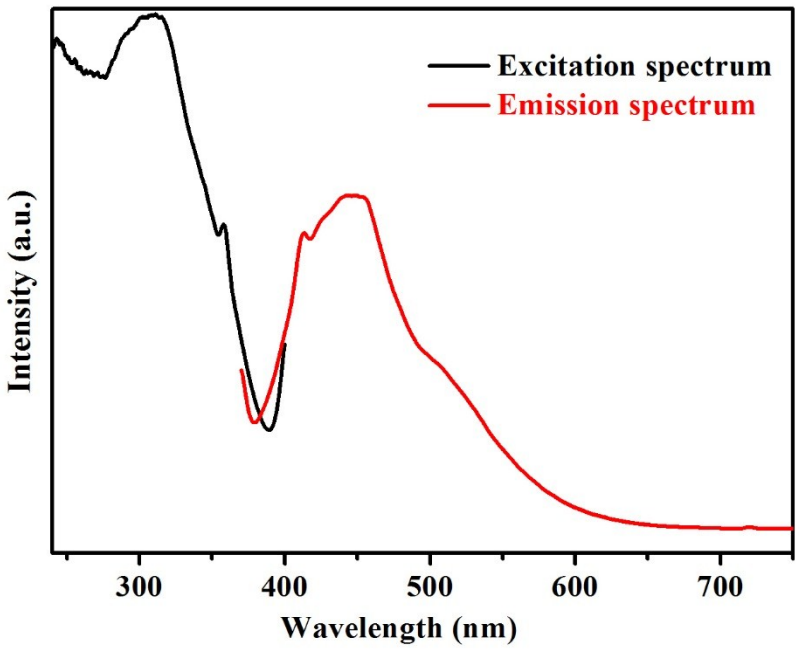


Fig S6. Excitation and emission spectrum of exfoliated MoS_2 nanoscrolls in water

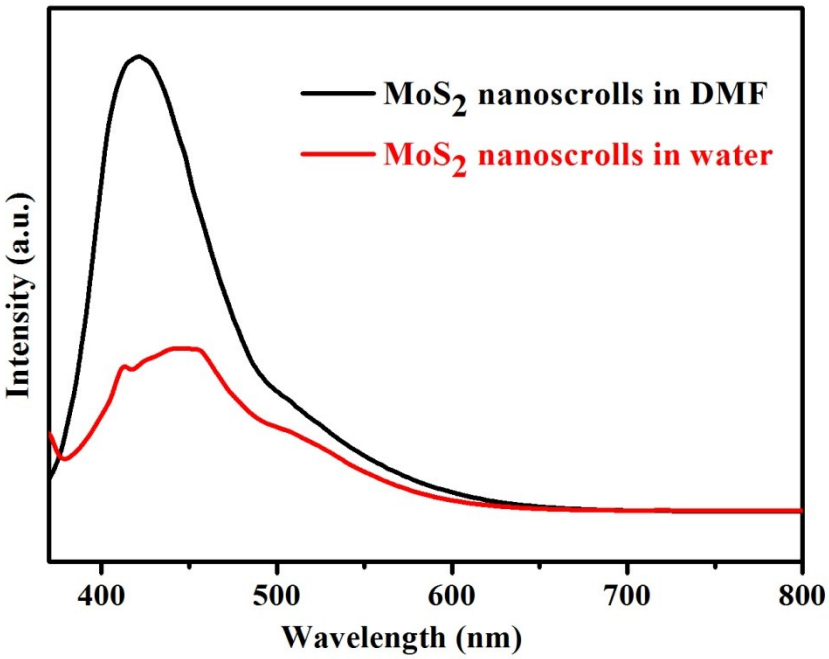


Fig S7. Emission spectrum of exfoliated MoS_2 nanoscrolls in DMF and water (excitation at 360 nm)

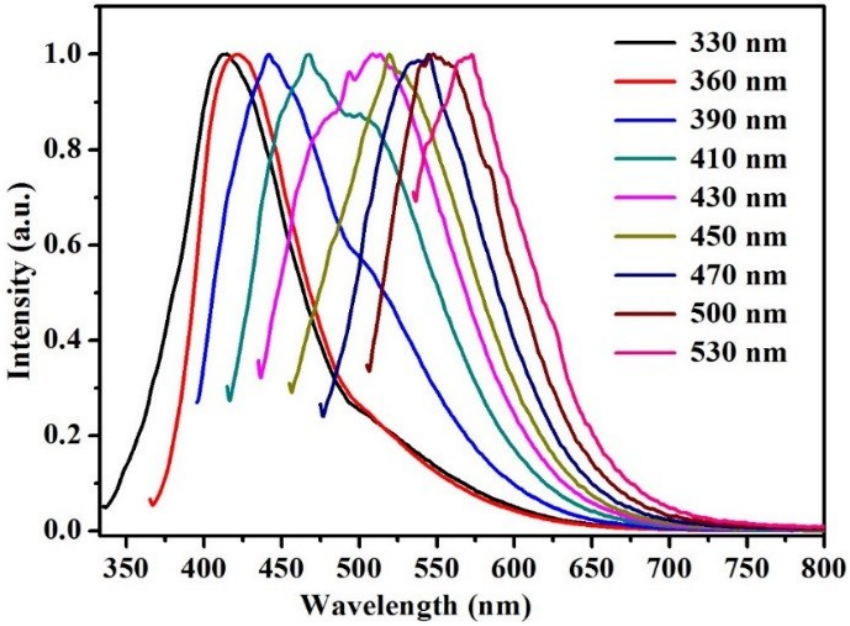


Fig S8. Normalized PL emission spectra of exfoliated MoS_2 nanoscrolls.

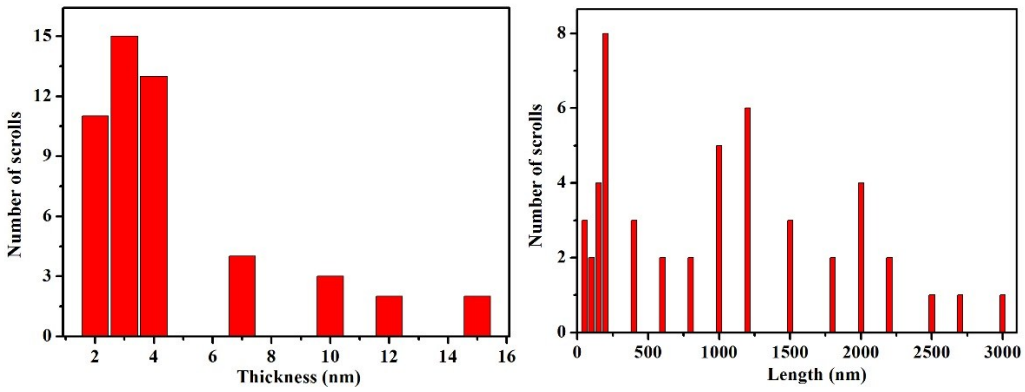


Fig S9. Thickness and length distribution of exfoliated MoS_2 nanoscrolls calculated using AFM analysis and TEM & FE-SEM images

Fluorescence microscopy analysis:

The epi-fluorescence microscopy analysis was carried out for the dried MoS_2 nanoscrolls on silica substrate and shown in Fig S10. It can be clearly seen from the images that the MoS_2 nanoscrolls coated areas on silica substrate exhibit fluorescence properties, while the uncoated areas doesn't show any fluorescence properties. The observed fluorescence from the solvent free (dried) MoS_2 nanoscrolls clearly confirms that the origin of the fluorescence is mainly from the MoS_2 nanoscrolls.

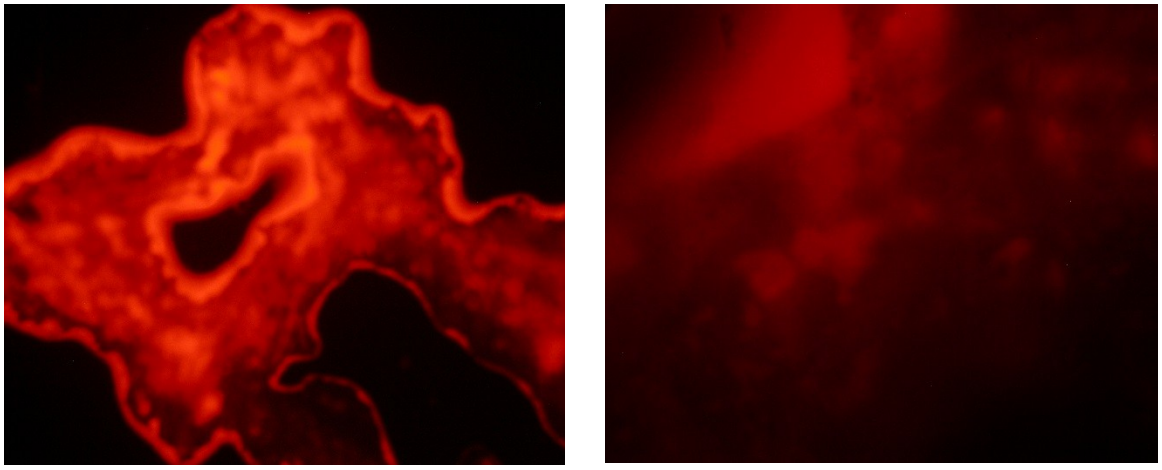


Fig S10. The epifluorescence microscopy images of dried MoS_2 nanoscrolls on silica substrate.