Electronic Supplementary Information for

A novel multi-flaws MoS_2 nanosheets piezocatalyst with superhigh degradation efficiency for ciprofloxacin

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Text S1

Analytical methods

The primary aromatic intermediates were separated on an Agilent TC-C18 column (150 × 4.6 mm i.d., 2.7 μm) using a gradient elution. The mobile phase was consisted of solvent A (high-purity water, pH 3.0, adjusted by formic acid) and solvent B (methanol, pH 3.0, adjusted by formic acid). The gradient elution program was as follows: gradient 10%−20% B at 0−6 min, 20%−30% B at 6−8 min, then keeps the 30% B at 8−12 min. The flow rate was kept at 0.5 $mL \cdot min^{-1}$, and the injection volume was 50 μL.

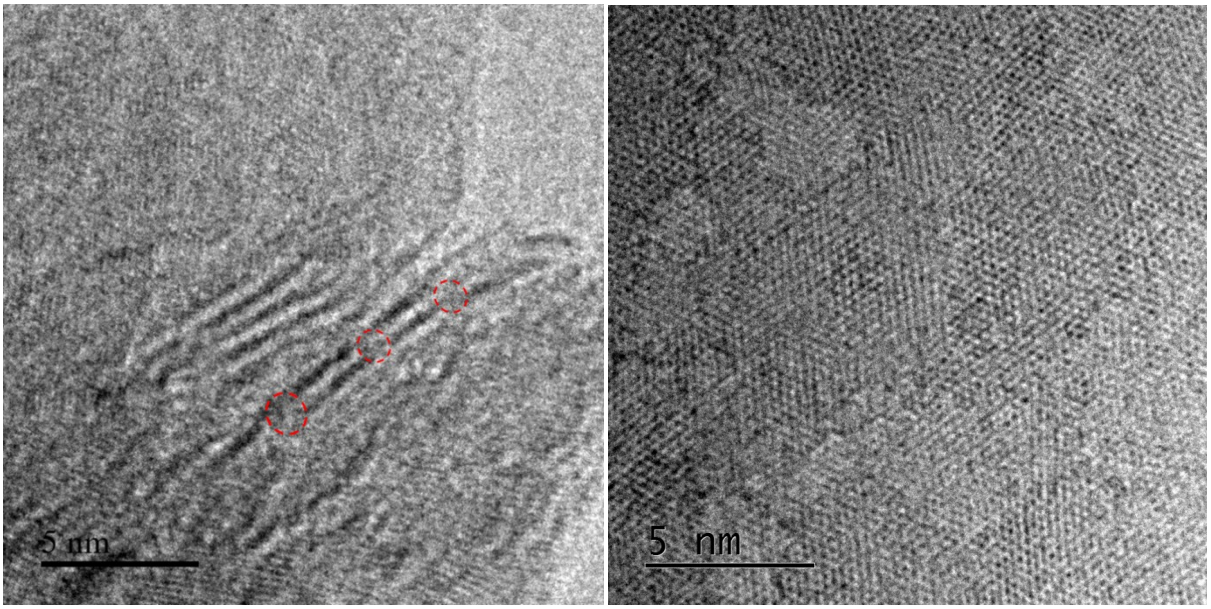


Fig. S1 TEM images of multi-flaw MoS_2 with cracks and voids on basal plane.

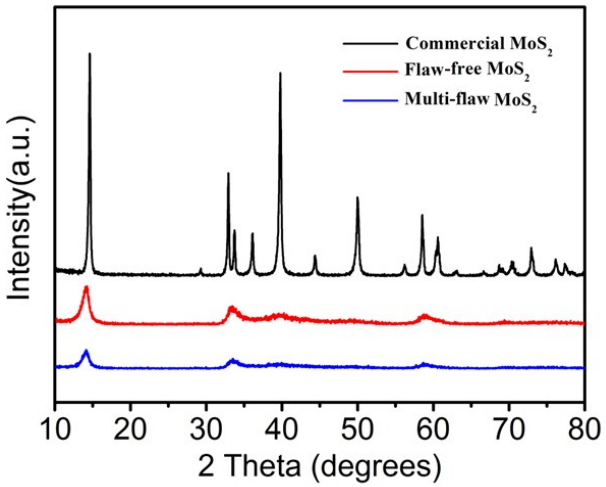


Fig. S2 XRD patterns of multi-flaw MoS_2, flaw-free MoS_2 and commercial MoS_2

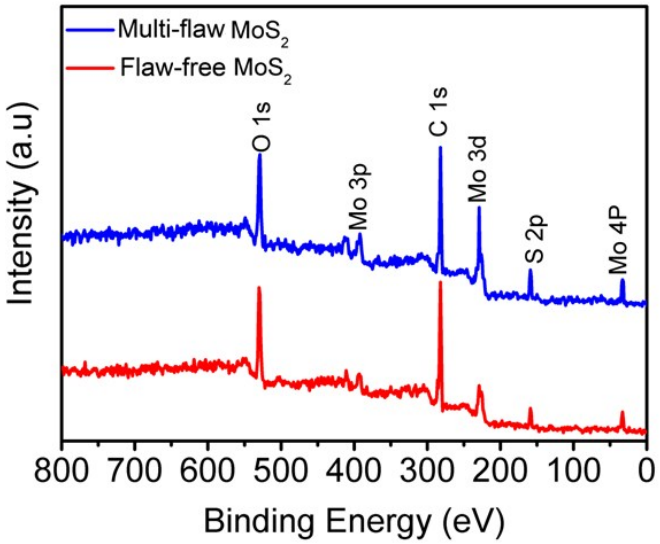


Fig. S3 full-scan XPS spectra of multi-flaw and flaw-free MoS_2

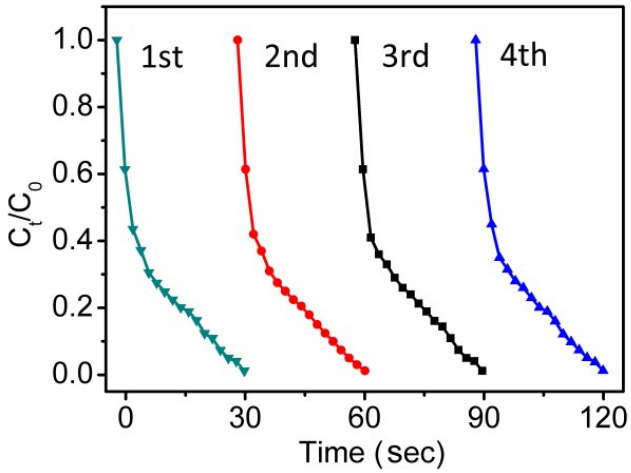


Fig. S4 cycling runs for the piezocatalytic degradation of CIP in the presence of multi-flaw MoS_2

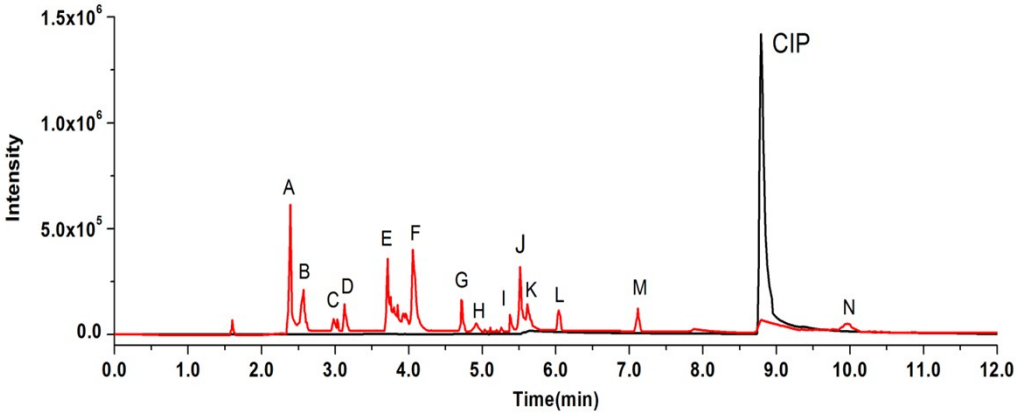
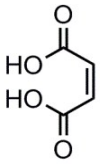
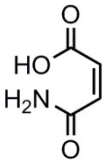
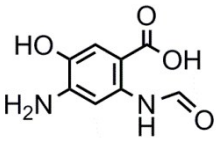
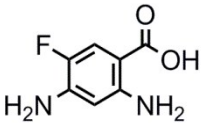
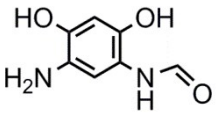
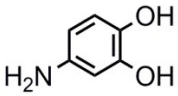
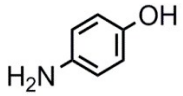
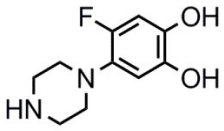
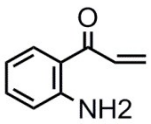


Fig. S5 the UPLC chromatogram of CIP solution at 0 sec (black line) and 30 sec (red line) of ultrasonic irridation

Table S1. The kinetic parameters for piezocatalytic degradation of CIP solution.

Catalysts	Kinetic models	Kinetic equations	CIP (20 mg/L)	
			k	R^2
Multi-flaw MoS_2	2	y = 0.135x + 0.4609	k_{a1} = 0.13571 L/mg·s (0-20s)	0.994
		y = 1.29 x – 22.68	k_{a2} = 1.29034 L/mg·s (20-30s)	0.981
Flaw-free MoS_2	1	y = 0.0112x + 0.644	0.01124 s^{-1}	0.994
Commercial MoS_2	1	y = 0.00745x + 0.486	0.00745 s^{-1}	0.975

Table S2. Main intermediates identified by UPLC /MS during the piezocatalytic degradation of ciprofloxacin

Product No.	Molecular ion $[M+H]^+$ (*m*/*z*)	R.T. (min)	Molecular Formula	Proposed Molecular Structure
A	116	2.39	$C_4H_4O_4$	
B	115	2.57	$C_4H_4O_3N$	
C	197	2.97	$C_8H_8O_4N_2$	
D	171	3.12	$C_7H_7O_2N_2F$	
E	169	3.71	$C_7H_8O_2N_3$	
F	126	4.05	$C_6H_7O_2N$	
G	109	4.71	C_6H_7ON	
H	213	4.92	$C_{10}H_{13}O_2N_2F$	
I	147	5.37	C_9H_9ON	

Continued Table S2

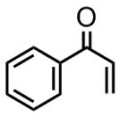
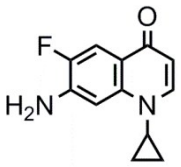
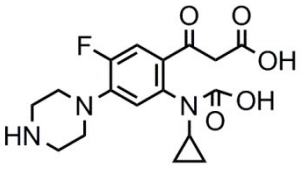
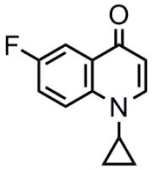
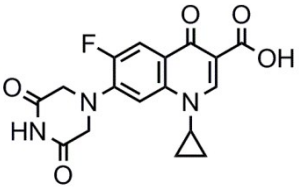
Products No.	Molecular ions $[M+H]^+$ (*m*/*z*)	R.T. (min)	Molecular Formulas	Proposed Molecular Structures
J	133	5.51	C_9H_8O	
K	219	5.61	$C_{12}H_{11}ON_2F$	
L	365	6.03	$C_{17}H_{20}O_5N_3F$	
M	203	7.11	$C_{12}H_{10}ONF$	
N	360	9.96	$C_{17}H_{14}O_5N_3F$	

Table S3. Total carbon (TC), inorganic carbon (IC), TOC, and mineralization of CIP solution at different degradation times.

Degradation times	TC (mg L^{-1})	IC (μg L^{-1})	TOC (mg L^{-1})	Mineralization (%)
0	19.75	581.2	19.17	0
30 s	18.49	357.1	18.13	5.42
1 min	17.81	744.6	17.07	10.95
2 min	15.82	481.9	15.34	19.98
3 min	13.31	435.1	12.87	32.86
4 min	10.89	944.6	9.95	48.09
5 min	9.17	740.0	8.43	56.02