

DATA

Table S1. Fabrication parameters of MoO_x rod-like SERS substrate

Sputtering parameter	Parameter value	Unit
Substrate temperature	30	°C
Target-to-substrate distance	7	cm
Base pressure	1.48x10 ⁻⁶	Torr
Working gas pressure	8.35x10 ⁻³	Torr
Power	60	W
Ratio between Ar: O ₂ (99.99% purity)	10:2	sccm

Table S2. Lattice parameters and crystal sizes of samples S15, S20, S25, and S30

	MoO ₃ (standard value) ²⁵	S15	S20	S25	S30
Lattice parameter					
a (Å)	3.962	3.963	3.970	3.962	3.960
b (Å)	13.858	13.887	13.887	13.891	13.888
c (Å)	3.696	3.698	3.698	3.696	3.698
Crystal size (nm)					
(020)		71.3	77.6	86.0	96.7

Table S3. The vibration modes and intensities of characteristic peaks in the Raman spectra for S15, S20, S25, and S30 samples.

Band frequency (cm ⁻¹)	Representation ²⁸	Attribution ²⁸
115	B _{2g}	Translational rigid MoO ₄ chain mode along “c” direction T _c
127	B _{3g}	Translational chain mode along “c” direction (T _c)
158	A _g /B _{1g}	Translational chain mode along “b” direction (T _b)
198	B _{2g}	τ O=M=O twist
216	A _g	Rotational rigid MoO ₄ chain mode R _c
245	B _{3g}	τ O=M=O twist
283	B _{2g}	δ O=M=O wagging
337	A _g , B _{1g}	δ O-M-O bend
378	B _{1g}	δ O-M-O scissor
473	A _g	u _{as} O–M–O stretch and bend
663	B _{2g} , B _{3g}	u _{as} O–M–O stretch
815	A _g	u _s M=O stretch MoO ₆
990	A _g , B _{1g}	u _{as} M=O asymmetric stretch

Table S4. Lattice parameters and crystal sizes of samples A30, A45, A60, A75, and A90.

	MoO ₃ (standard value) ²⁵	A30	A45	A60	A75	A90
Lattice parameter (Å)						
a (Å)	3.962	3.970	3.974	3.965	3.963	3.963
b (Å)	13.858	13.885	13.886	13.881	13.881	13.886
c (Å)	3.696	3.695	3.698	3.700	3.697	3.697
Crystal size (nm)						
(020)		77.5	85.5	86.0	85.5	86.0
(110)		43.4	54.1	61.9	61.9	61.9

Table S5: SERS intensity of R6G at 609 cm⁻¹ peak absorbing on six MoO_x SERS substrates which fabricated under the same condition

No.	1	2	3	4	5	6
Intensity (a.u.)	3400	3200	3128	2900	3125	3300
Summary						
Count	Sum		Average	SD		RSD (%)
6	19053		3175.5	171.58526		5.38

Table S6: SERS intensity of R6G at 609 cm⁻¹ peak at five random positions with 1 ppm adsorbed on the surface of MoO_x SERS substrate produced after 3 months, 6 months, and 9 months.

No.	3 months		6 months		9 months	
1	3000		3200		3100	
2	3100		2950		3200	
3	2800		3257		2500	
4	3500		2400		2800	
5	3200		2784		2700	
Summary						
Sample	count	sum	average	SD	RSD (%)	
3 months	5	15600	3120	258.84358	8.23	
6 months	5	14591	2918	347.04063	11.89	
9 months	5	14300	2860	482.70074	13.32	