

Supporting information

Low power density, high-efficiency Reflective Raman system for polymer SERS substrates

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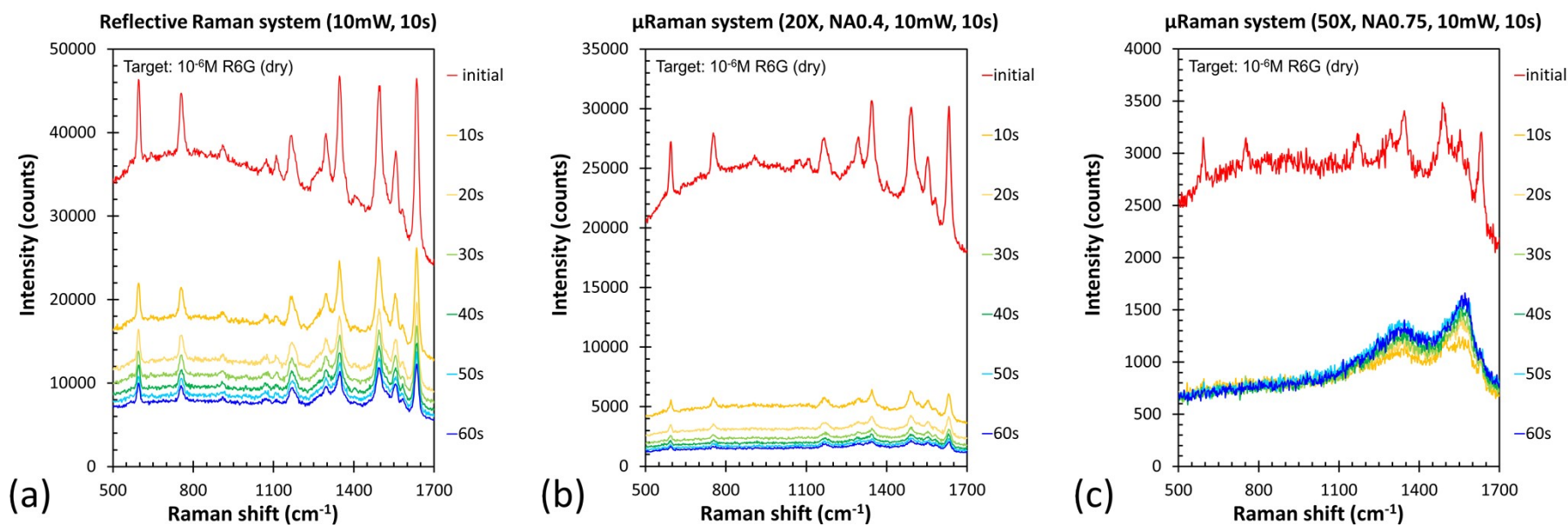


Fig. S1 The time dependence Raman spectra of 10^{-6} M R6G on polymer SERS substrate by (a) RR system, (b) 20X, NA0.4 μ -Raman system, and (c) 50X, NA0.75 μ -Raman system. The 532nm laser power is 10 mW, and the integration time is 10 seconds.

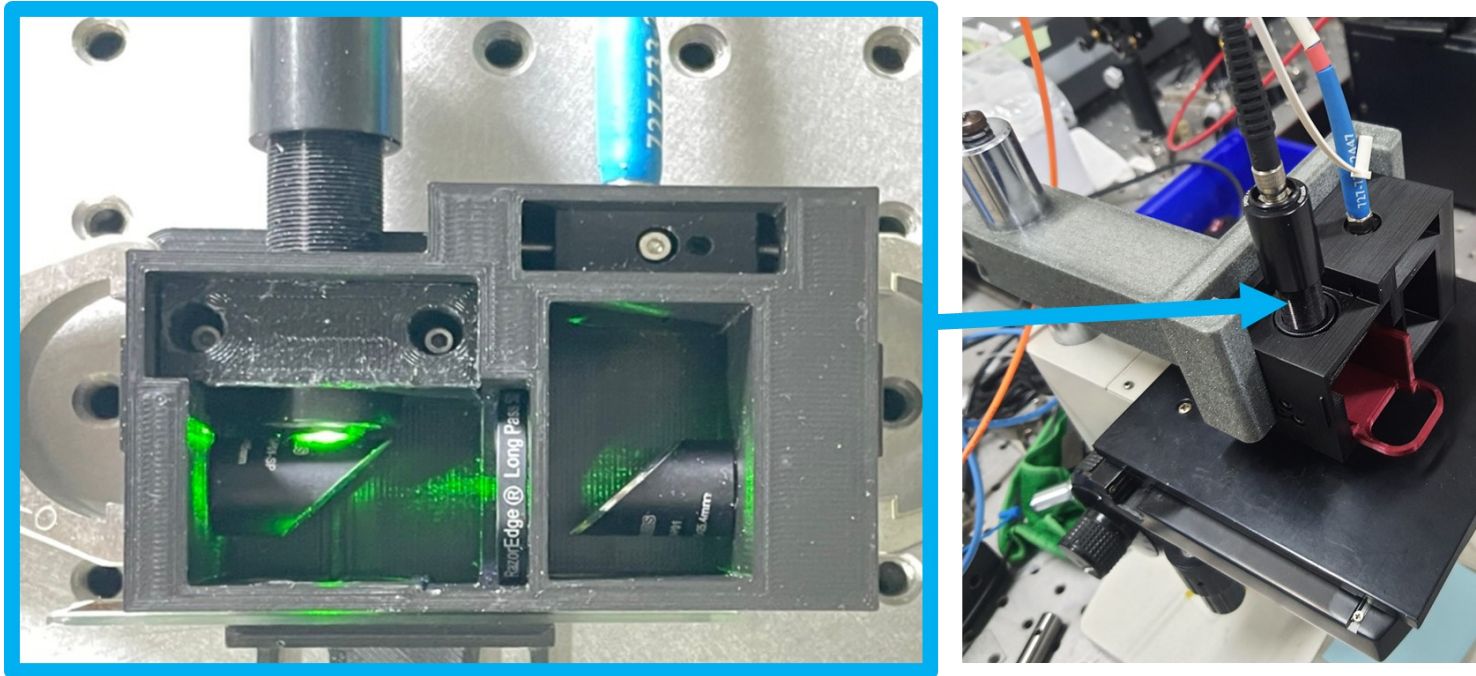


Fig. S2 The picture of our home-built RR system

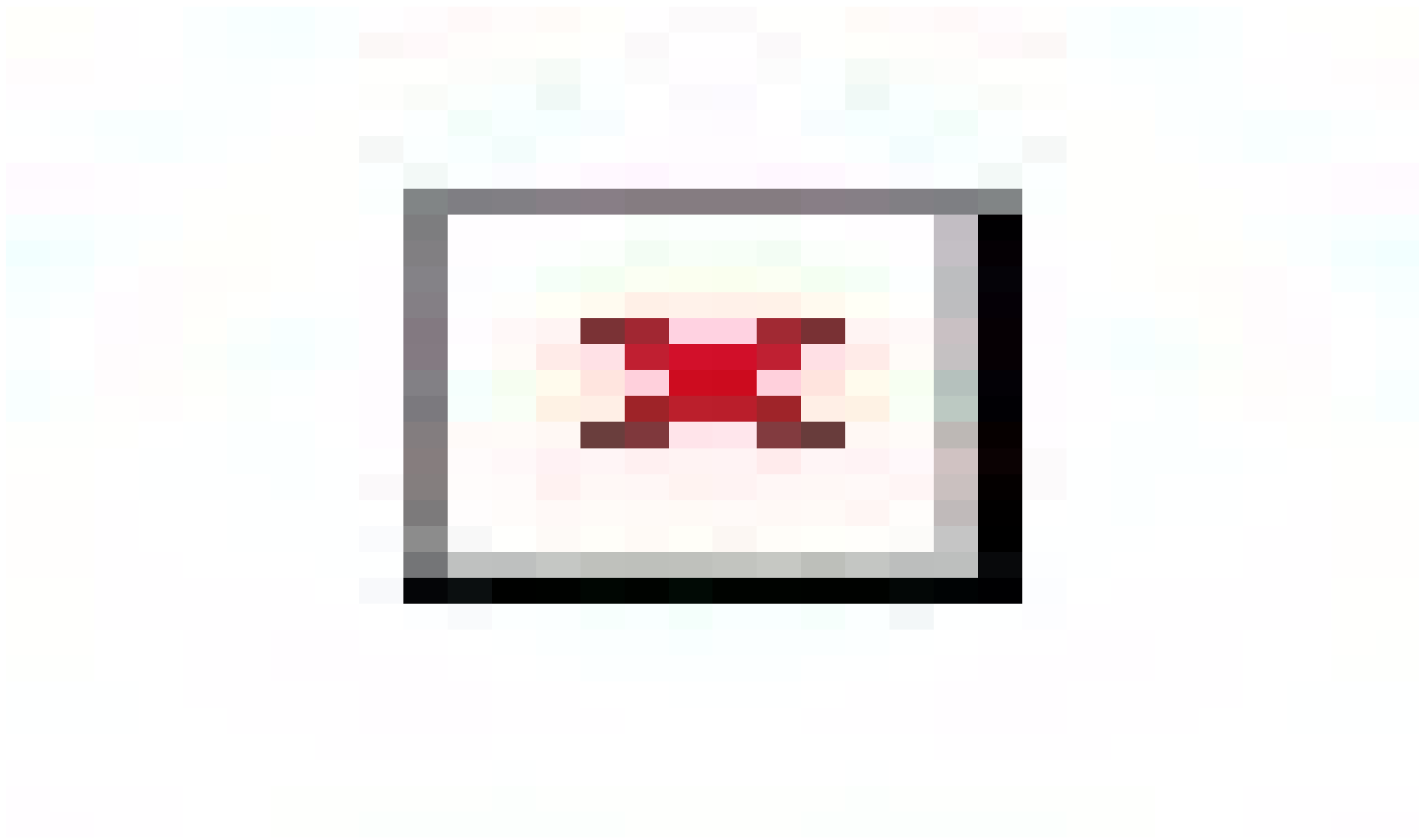
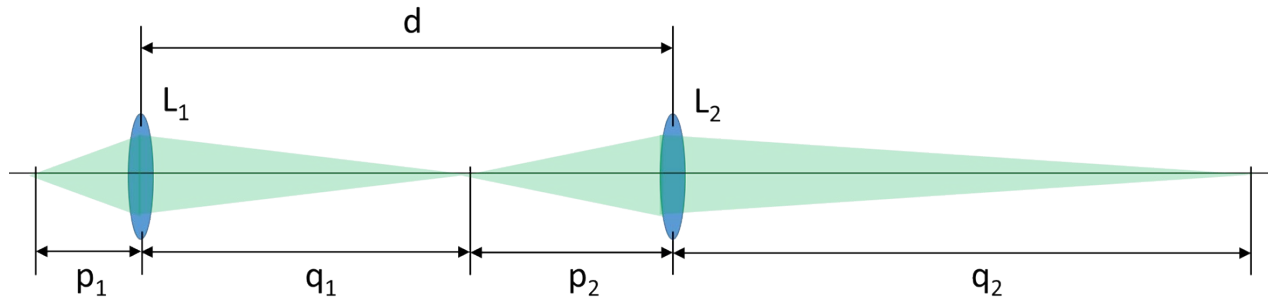


Fig. S3 The regression line of the Raman signal on polymer SERS substrate and the slope ratio between RR and μ -Raman systems



$$\frac{1}{p_1} + \frac{1}{q_1} = \frac{1}{f_1} \quad \text{①}$$

$$\frac{1}{p_2} + \frac{1}{q_2} = \frac{1}{f_2} \quad \text{②}$$

$$p_2 = d - q_1 \quad \text{③}$$

Based on the above image formation equation, if the focal length of the 1st and the 2nd aspherical lenses is 6.2mm (f_1) and 18.4 mm (f_2), and the core diameter of the fiber laser is 105 μm , we can calculate the magnifications and focusing spot diameters on sample surface listed in Table S2. We can adjust the spot diameter in the range of 2.22~2.78 times the fiber core size. In this article, we selected p_1 close to 6 mm, and the theoretical spot size on the sample plane is about 275 μm .

Table. S1 Relation of spot size and lens position parameters.

p_1 (mm)	d (mm)	q_1 (mm)	p_2 (mm)	q_2 (mm)	magnification	spot diameter (μm)
6.10	50.49	-378.20	428.69	19.23	-2.78	292
6.05	50.50	-250.07	300.57	19.60	-2.70	283
6.00	50.51	-186.00	236.51	19.95	-2.62	275
5.95	50.52	-147.56	198.08	20.28	-2.54	267
5.90	50.53	-121.93	172.46	20.60	-2.47	259
5.85	50.54	-103.63	154.17	20.89	-2.40	252
5.80	50.55	-89.90	140.45	21.17	-2.34	245
5.75	50.56	-79.22	129.78	21.44	-2.28	239
5.70	50.57	-70.68	121.25	21.69	-2.22	233

Table. S2 Components list of RR system

#	Component	Part number
1	Fiber port (from laser)	Thorlabs, SM05FC
2	1 st aspherical lens	Thorlabs, C171TMD-A
3	Laser-line filter	Semrock, LL01-532-12.5
4	2 nd aspherical lens	Thorlabs, C280TMD-A
5	1 st 90° off-axis parabolic mirror with a drilled hole (0.5", f=15mm)	Thorlabs, MPD00M9-P01-SP
6	Sample (ex: silicon)	Mesophotonics, Klarite sCAL
7	Long-pass filter	Semrock, LP03-532RU-25
8	2 nd 90° off-axis parabolic mirror (0.5", f=33mm)	Thorlabs, MPD01M9-P01
9	Fiber port (to spectrometer)	Thorlabs, SM05SMA
10	Adjustable lens tube	SM05V10 + SM05L10

