Electronic Supplementary Material (ESI) for Nanoscale.


# Supporting Information

## Tuning Nonlinear Optical Absorption Properties of $WS_2$ Nanosheets

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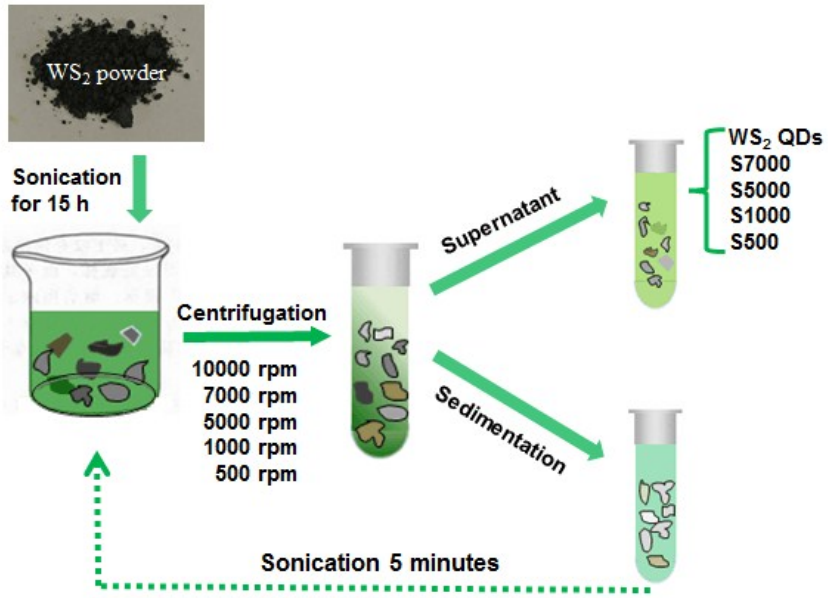


**Fig. S1**. Experimental procedures for fabricating $WS_2$ quantum dots and nanosheets with different size and thickness distribution.


**Fig. S2.** Digital photographs of prepared $WS_2$/PMMA and $WS_2$QD/PMMA composites. They are S500, S1000, S5000, S7000 and $WS_2$QDs from the left to right, respectively

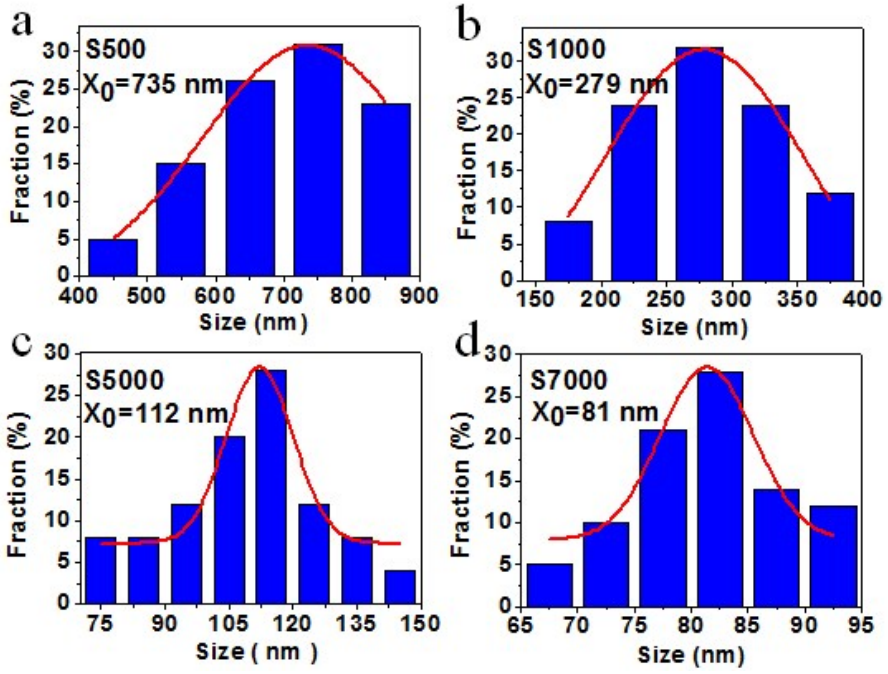


**Fig. S3**. Size distribution of $WS_2$ sheets exfoliated in NMP and subsequently separated under different centrifugation rates of a-500, b-1000, c-5000, and d-7000 rpm, respectively.

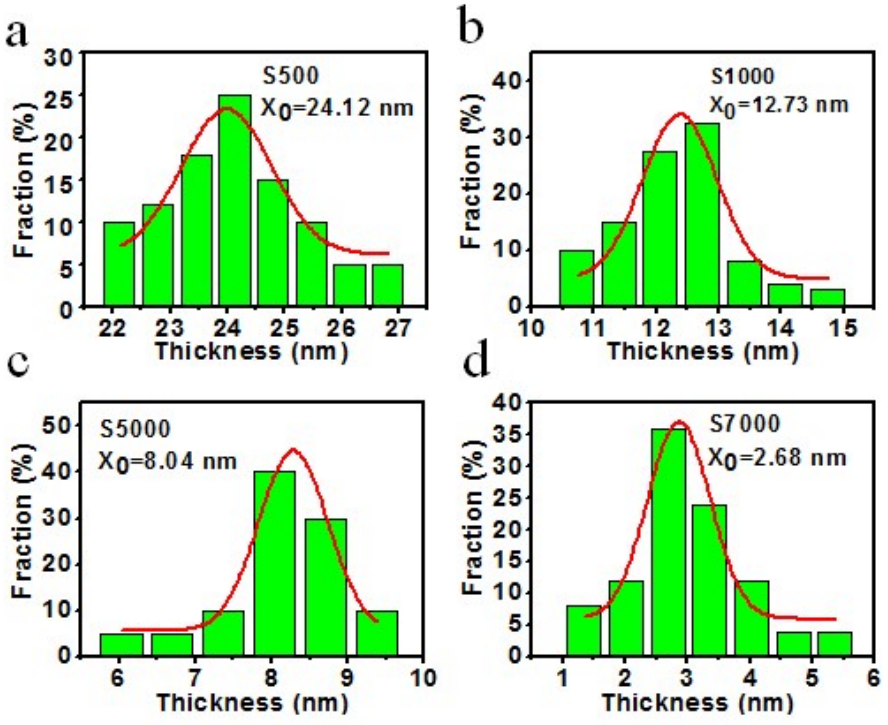


**Fig. S4**. Thickness distribution of $WS_2$ sheets exfoliated in NMP and subsequently separated under different centrifugation rates of a-500, b-1000, c-5000, and d-7000 rpm, respectively. The interlayer space of $WS_2$ is 0.62 nm.

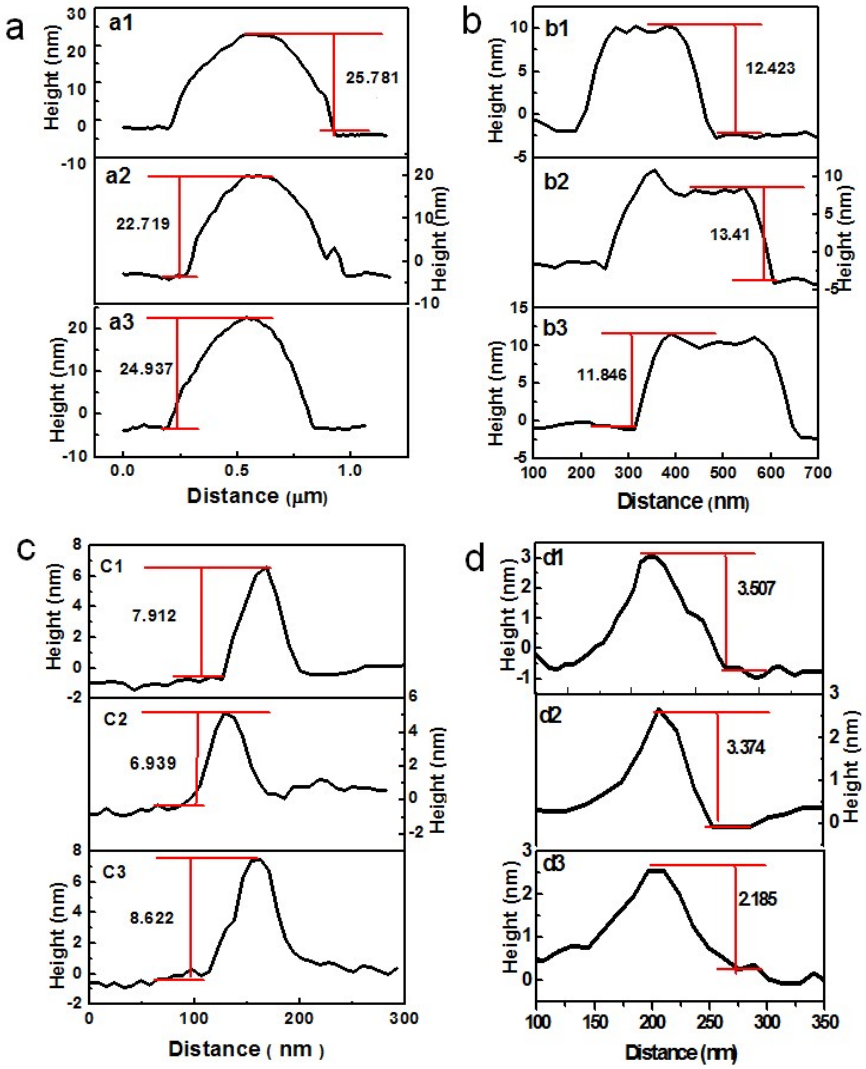


**Fig. S5**. Randomly selected section height profiles of $WS_2$ sheets exfoliated in NMP and subsequently separated under different centrifugation rates of a-500, b-1000, c-5000, and d-7000 rpm, respectively. The interlayer space of $WS_2$ is 0.62 nm.

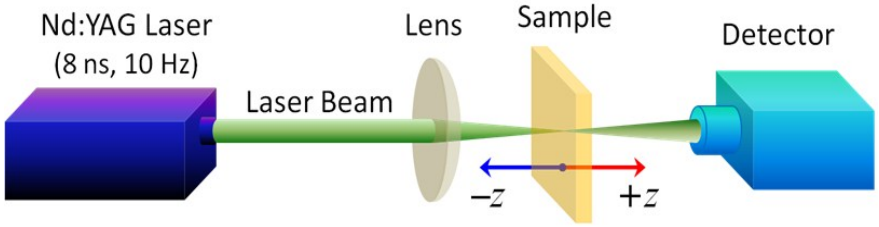


**Fig. S6.** Experimental setup of Z-scan technique.

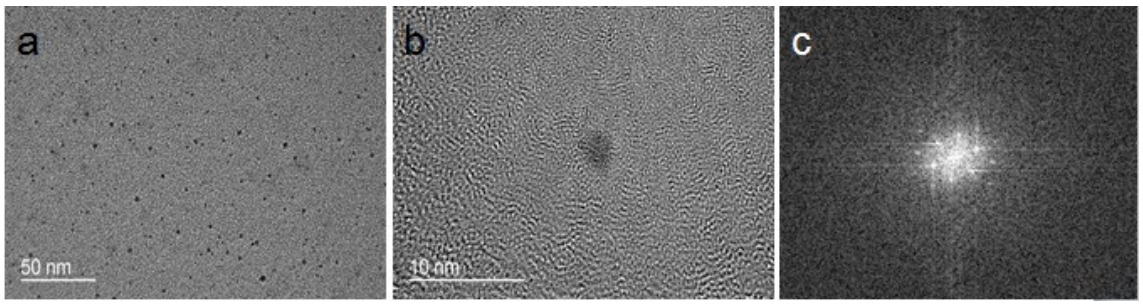


**Fig. S7.** a) TEM image of the $WS_2$QDs assembled on Cu grid coated with ultrathin amorphous carbon film; b) HRTEM image of a typical single $WS_2$QD, and corresponding selected area FFT image c).

**Table S1.** The nonlinear optical property onset thresholds ($F_{ON}$) and optical limiting thresholds ($F_{OL}$) of different materials for the nanosecond laser operating at 532 and 1064 nm, respectively.

| Materials | 532 nm | | | 1064 nm | | |
|---|---|---|---|---|---|---|
| | $T_L$(%) | $F_{ON}$ (J/cm$^2$) | $F_{OL}$ (J/cm$^2$) | $T_L$(%) | $F_{ON}$ (J/cm$^2$) | $F_{OL}$ (J/cm$^2$) |
| Pd NW [1] | 80 | 0.09 | 0.90 | 80 | 0.30 | 8.00 |
| CdS NPs [2] | 70 | 0.30 | 2.55 | 70 | 1.00 | 16.40 |
| Au NP [3] | 70 | 0.07 | 0.60 | 77 | 0.60 | 7.50 |
| MWCNTs [2] | 70 | 0.04 | 0.68 | 70 | 0.13 | 9.69 |
| CNTs-PTh-CdS [2] | 70 | 0.03 | 0.47 | 70 | 0.09 | 6.66 |
| GO [4] | 70 | 0.19 | 1.19 | 75 | 1.36 | 10.32 |
| GO NRs [5] | 70 | 0.10 | 1.00 | 70 | 0.20 | 4.00 |
| $PNP^+GO^-$ [6] | 63 | 0.21 | 1.55 | 74 | 2.00 | 8.10 |
| PEG-OPE-rGO [4] | 70 | 0.07 | 0.31 | 75 | 0.54 | 3.50 |
| Graphene NSs [5] | 70 | 0.10 | 0.50 | 70 | 0.20 | 6.30 |
| Graphene NRs [5] | 70 | 0.10 | 0.70 | 70 | 0.20 | 3.40 |
| Graphene [7] | 73 | 0.01 | 0.08 | 85 | 0.01 | 0.1 |
| $MoS_2$/PMMA [8] | 44 | 0.01 | 0.40 | 53 | 0.04 | 1.30 |
| S7000* | 44 | 0.011 | 0.245 | 65 | 0.036 | 0.48 |
| $WS_2$QD/PMMA* | 48 | 0.010 | 0.062 | 63 | 0.030 | 0.10 |

*This work

**Table S2.** The absorption coefficient α (L $g^{-1}$ $cm^{-1}$) of different samples at 532 and 1064 nm, respectively.

| Samples | S500 | S1000 | S5000 | S7000 |
|---|---|---|---|---|
| α (L $g^{-1}$ $cm^{-1}$) @ 532 nm | 13.98 | 21.84 | 27.92 | 32.21 |
| α (L $g^{-1}$ $cm^{-1}$) @1064 nm | 8.26 | 10.78 | 10.85 | 10.95 |

## References:


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