

Resonant and Off-Resonant Phonon Properties of Wurtzite ZnS: Effect of Morphology on Fröhlich Coupling and Phonon Lifetime

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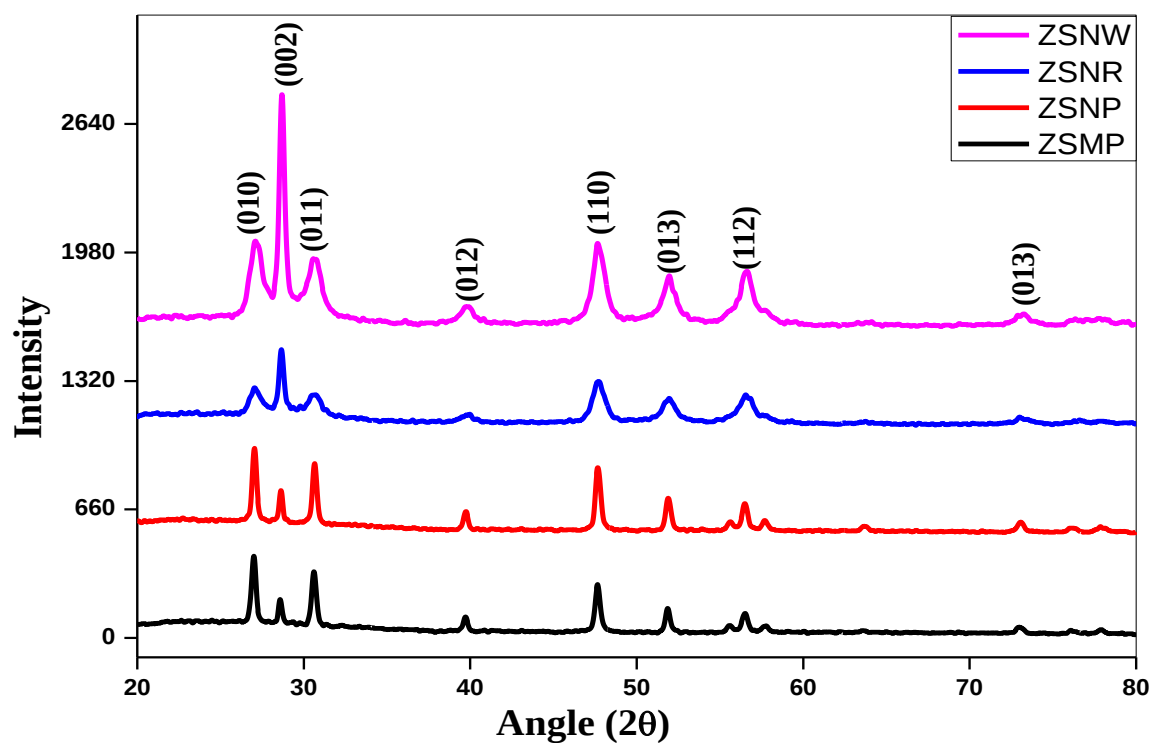


Figure S1: X-ray Diffraction pattern of ZnS micro-particles, nanoparticles, nanorods and nanowires. Major peaks are indexed in the figure which matches with the standard hexagonal wurtzite ZnS structure (JCPDS card #36-1450). Stronger and narrower (002) diffraction peak indicates the preferential growth of nanorods and nanowires along c-axis.

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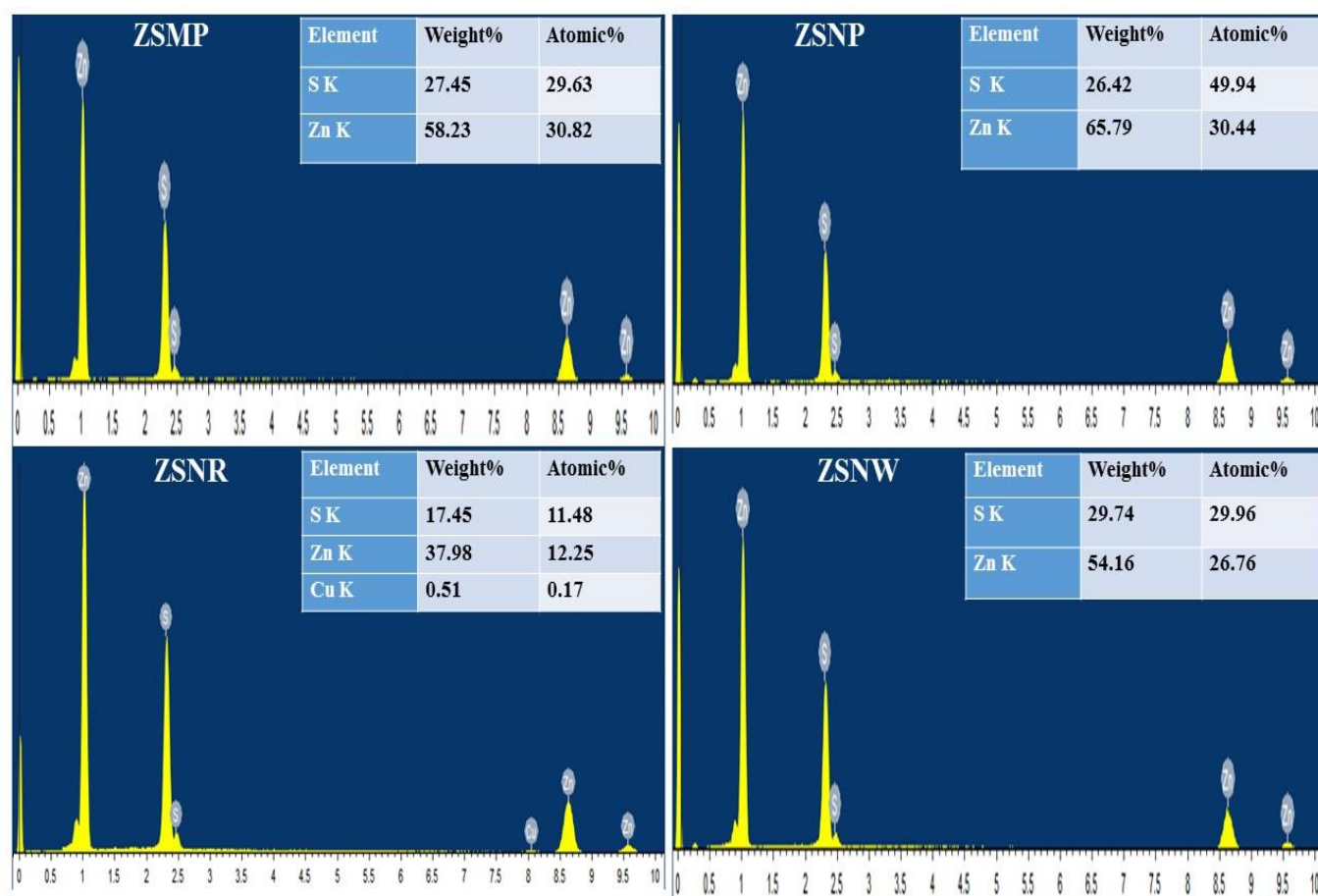


Figure S2: Energy dispersive spectrum of micro-particle, nanoparticles, long nanorods and nanowires. Atomic ratio of Zn to S is tabulated in the inset table shows which corresponds to the stoichiometric ratio of ZnS composition.

Table. S1: Comparison of crystallite size from Scherrer analysis with error estimates and TEM measurements with standard deviations of ZnS micro-particles, nanoparticles, nanorods and nanowires.

Sample code	Scherrer's Method D (in nm)	TEM	
		Particle size	Standard deviation (in nm)
ZSMP	89.1±7.8	1.5-2 µm	28.4
ZSNP	27.9±7.3	30-40 nm	4.9
ZSNR	10.5±3.5	40-50 nm	10.1
ZSNW	9.4±4.3	30-40 nm	3.4

Table S2: Observed resonant Raman peaks of ZnS micro-particles, nanoparticles, nanorods and nanowires. The precision of the experimental Raman setup 0.15 cm^{-1} so we have used 2 significant figures for the wavenumber measurement.

Sample Code	Peak position (cm^{-1}) LO					Peak position (cm^{-1}) TO		
	1LO	2LO	3LO	4LO	5LO	1TO	2TO	3TO
ZSMP	347.46	696.64	1043.78	-----	-----	265.52	-----	-----
ZSNP	350.88	696.20	1049.59	1399.26	1742.52	266.67	-----	-----
ZSNR	349.18	696.68	1045.20	1391.23	1735.30	271.84	621.12	955.61
ZSNW	346.63	696.69	1044.29	1391.22	1735.15	267.41	618.46	954.39

Table S3: Obtained Raman linewidth and calculated first order LO phonon lifetime, Fröhlich interaction and force constant with different morphology.

Sample Code	Raman linewidth of 1LO phonon (cm^{-1})	LO phonon lifetime (ps)	Fröhlich interaction
ZSMP	33.8 ± 0.3	15.7 ± 0.02	0.8 ± 0.03
ZSNP	34.8 ± 0.2	15.3 ± 0.01	0.8 ± 0.02
ZSNR	35.2 ± 0.3	15.1 ± 0.02	1.4 ± 0.02
ZSNW	35.9 ± 0.2	14.8 ± 0.03	1.6 ± 0.03