

SYNTHESIS AND CHARACTERIZATION OF COLLOIDAL INDIUM NITRIDE  
NANOCRYSTALS AND STUDY OF THEIR ELECTRONIC STRUCTURE AND  
SIZE AND SHAPE DEPENDENT OPTICAL PROPERTIES

By

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Supplementary Information

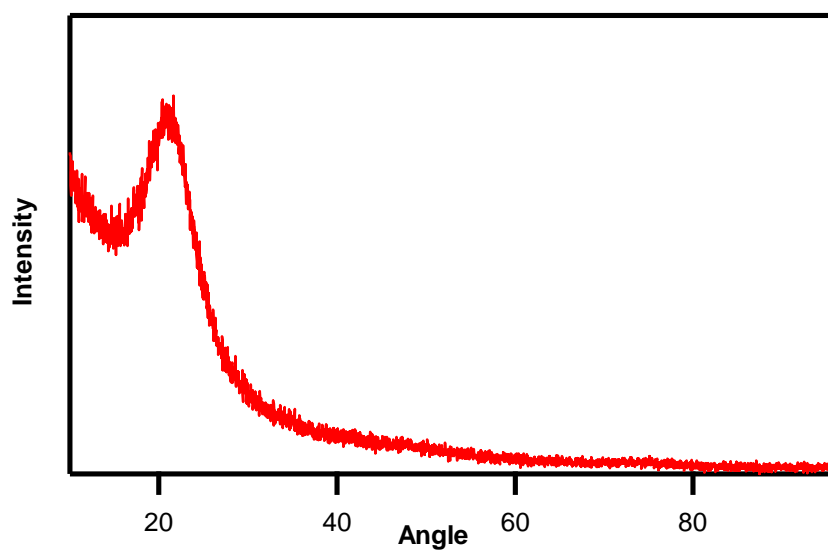


Figure S1:- Amorphous PXRD pattern which indicates dominating presence of In metal nanoparticles

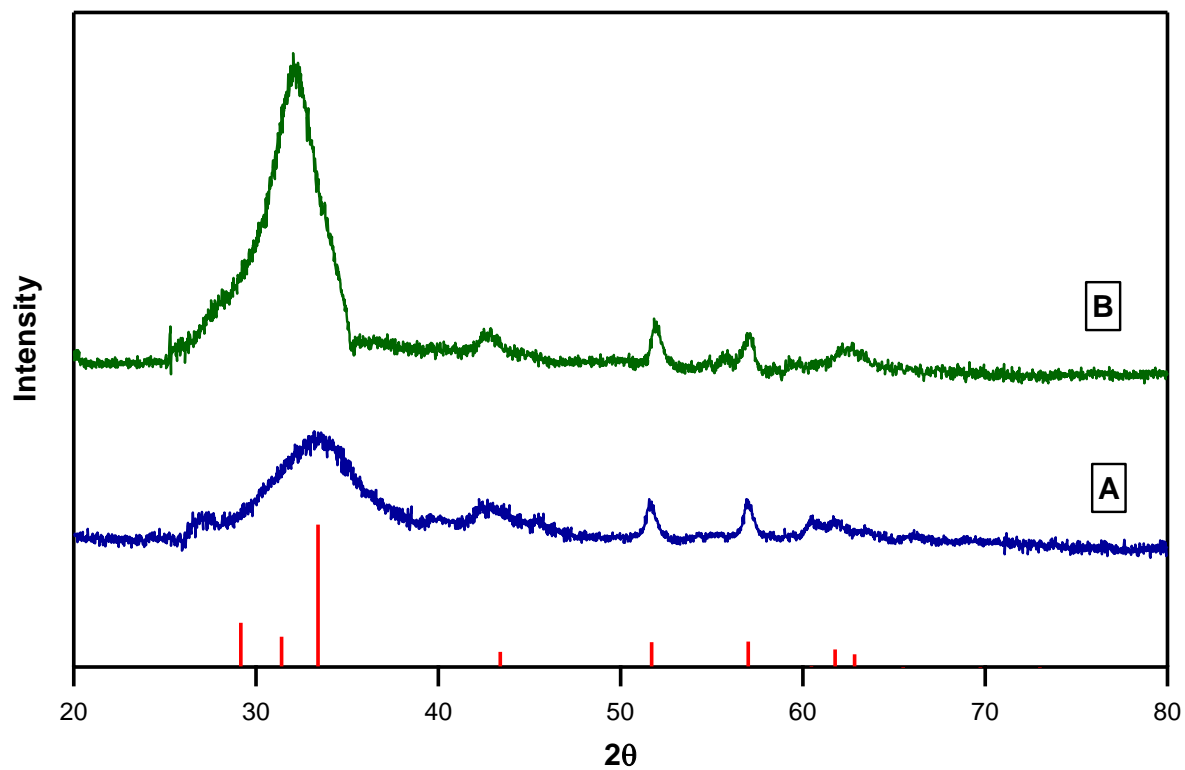


Figure S2:- PXRD pattern of InN sample prepared with TMED A) Aliquot taken at 45 min. B) Final Sample. Both shows presence of wurtzite phase InN. Crystallite size measured for the sample at 45 min. was  $\sim 3.22$  nm and for the final sample it was  $\sim 5.72$  nm.

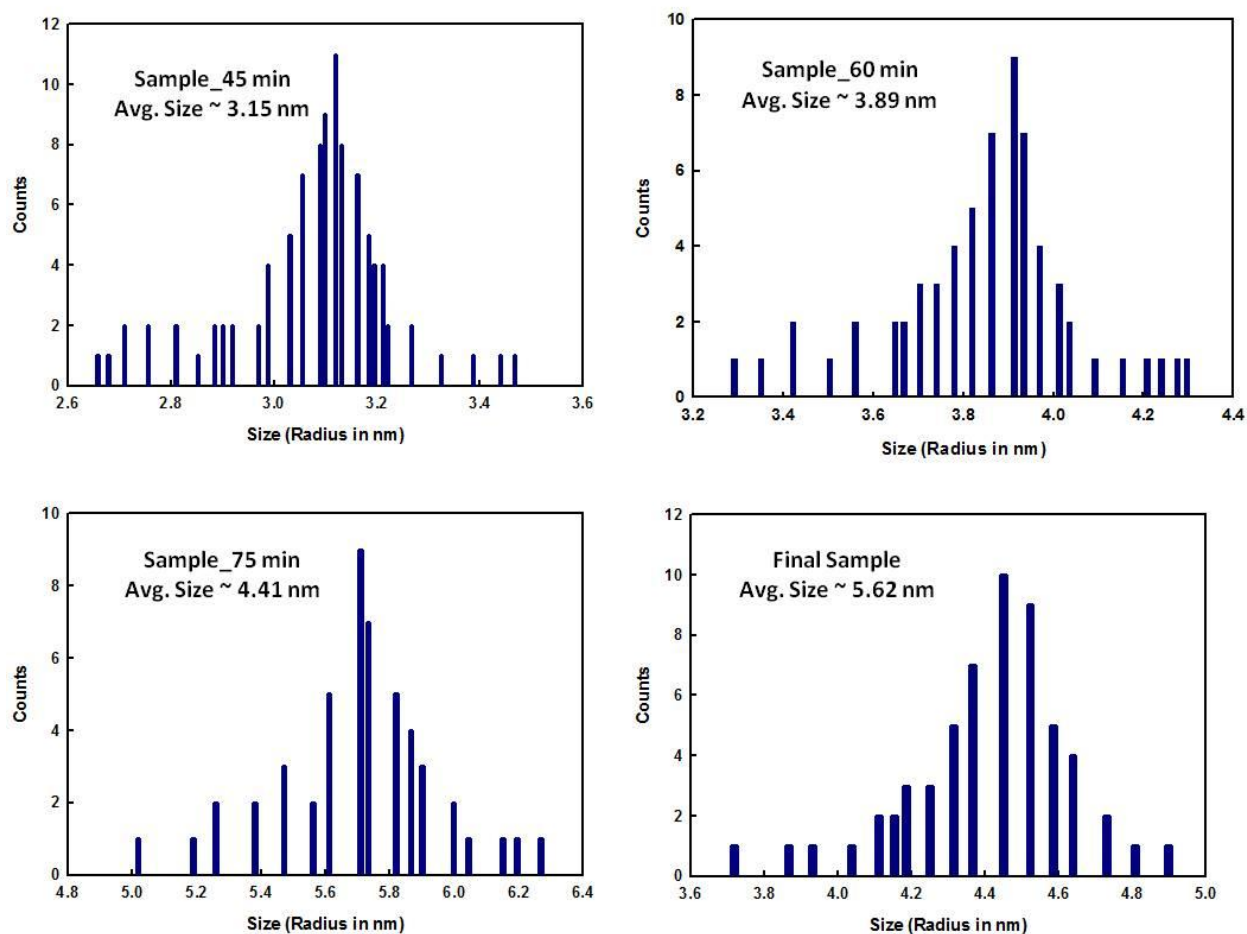


Figure S3:- Size distribution analysis of the particles obtained from the aliquots. The Average size corresponds to the radius of the particles.

Considering the size distribution, Aliquot 1 =  $3.2 \pm 0.25$  nm

Aliquot 2 =  $3.9 \pm 0.57$  nm

Aliquot 3 =  $4.4 \pm 0.67$  nm

Aliquot 4 =  $5.6 \pm 0.70$  nm

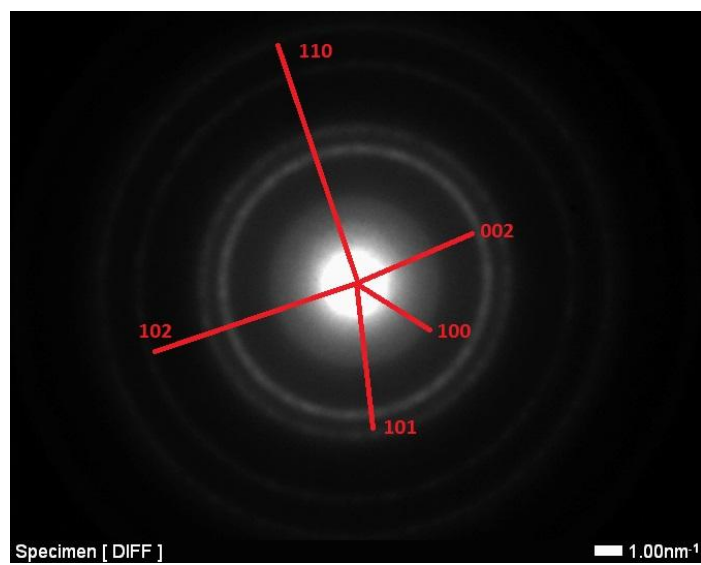


Figure S4:- SAED pattern of InN nanocrystals which supports the Wurtzite phase.

**TEM images of the nanocrystals synthesized using OLA:OA ratio of 3:1**

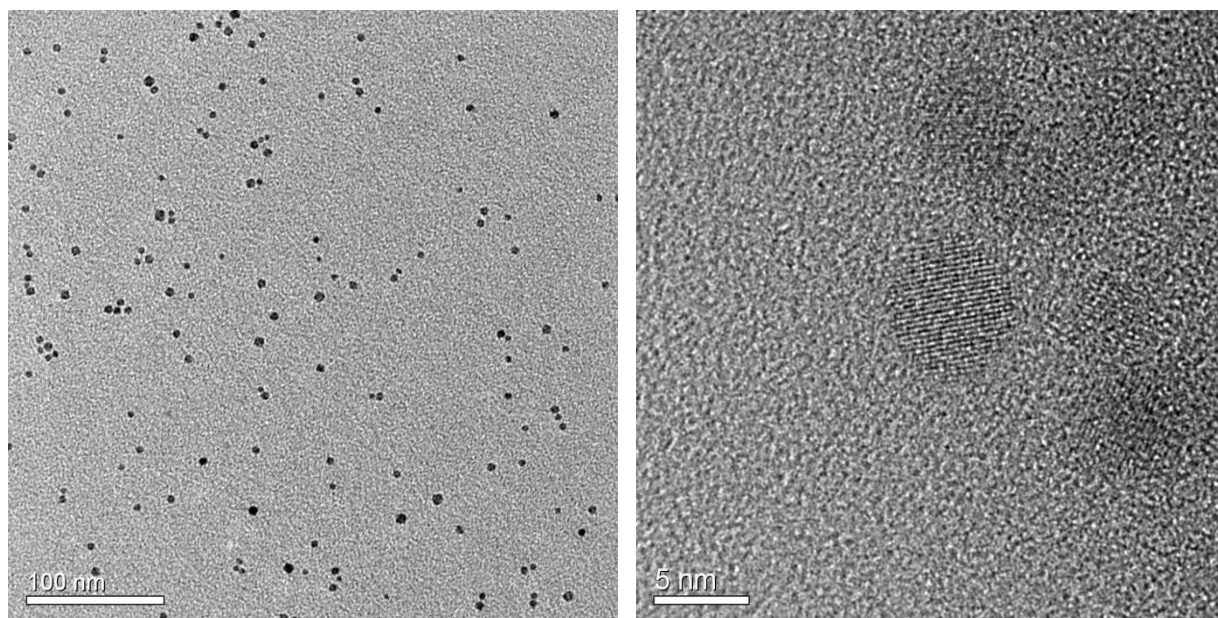


Figure S6:- TEM and HRTEM image of the nanocrystals taken from aliquot 1. Average Size of nanoparticles 2.28 nm

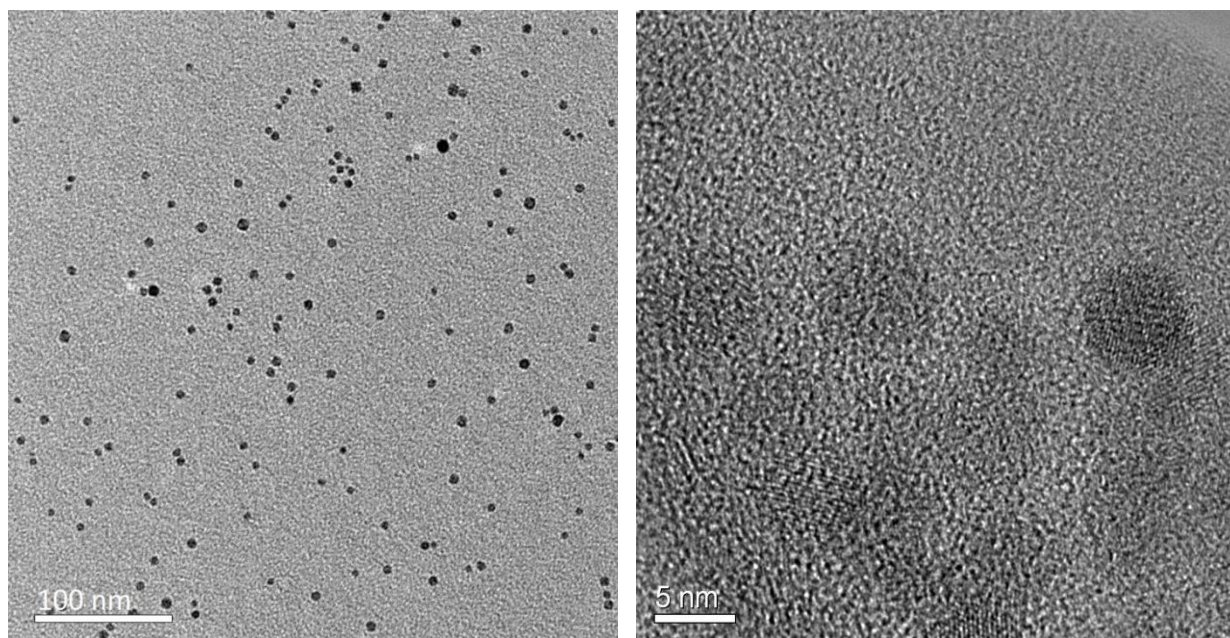


Figure S7:- TEM and HRTEM image of the nanocrystals taken from aliquot 1. Average Size of nanoparticles 2.45 nm



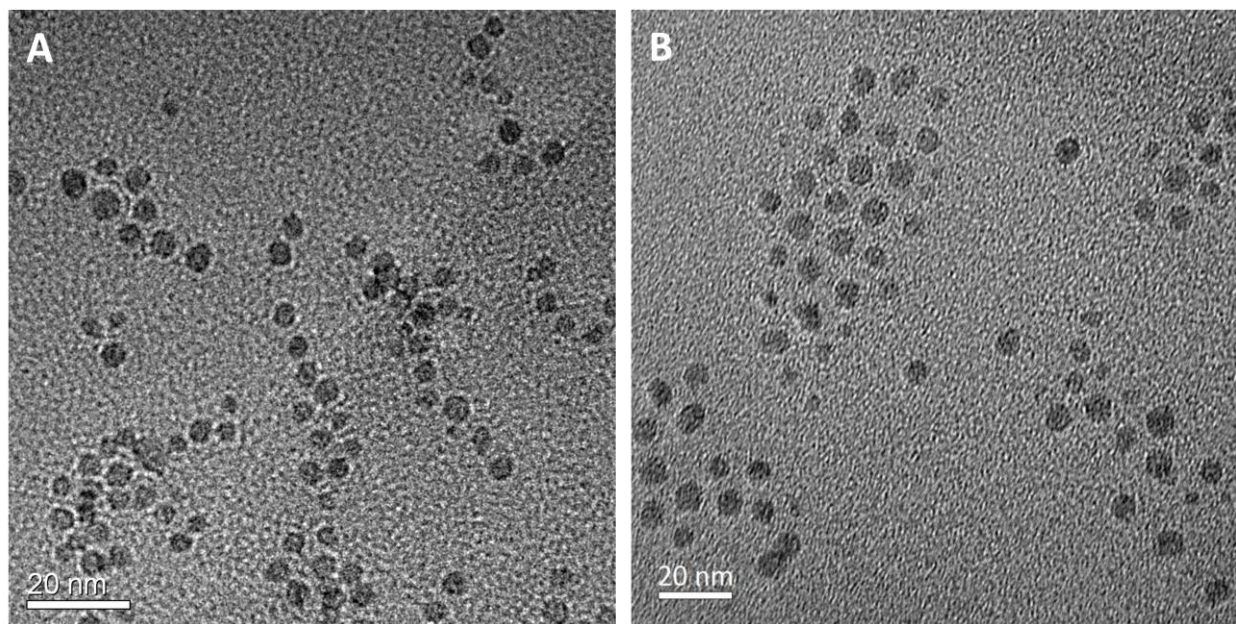


Figure S8:- TEM images of the nanocrystals taken from aliquot 4(A) and 7(B). Average Size of nanoparticles 2.79 nm and 3.91 nm

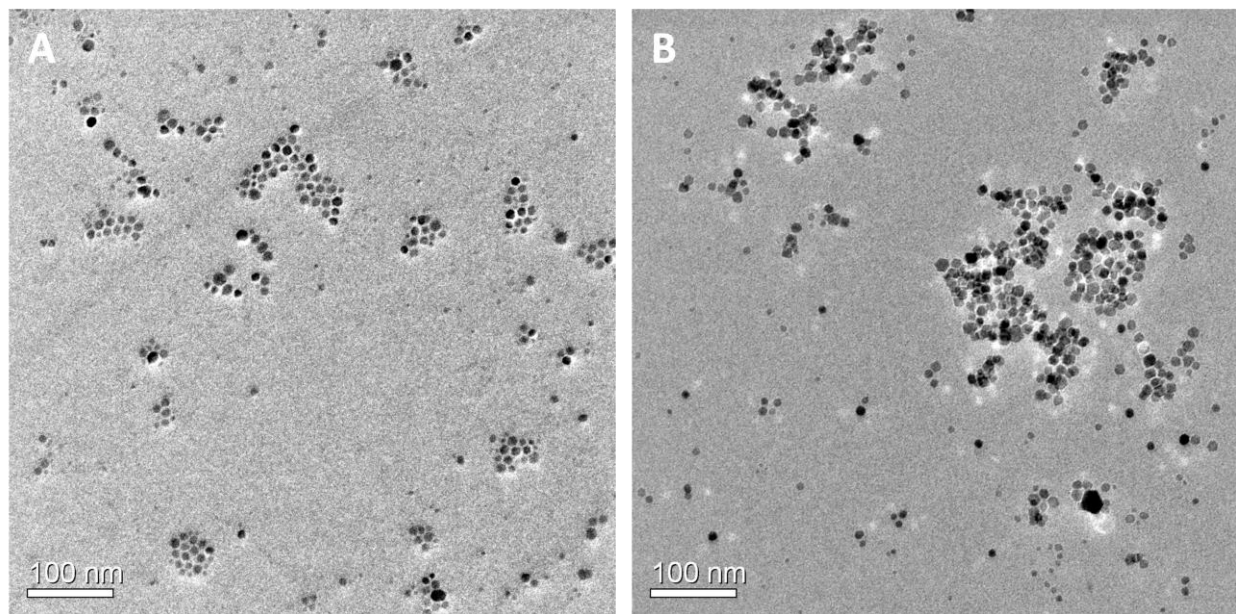


Figure S9:- TEM images of the nanocrystals taken from aliquot 8(A) and final sample (B). Average radius of nanoparticles is 4.54 nm and 4.92 nm

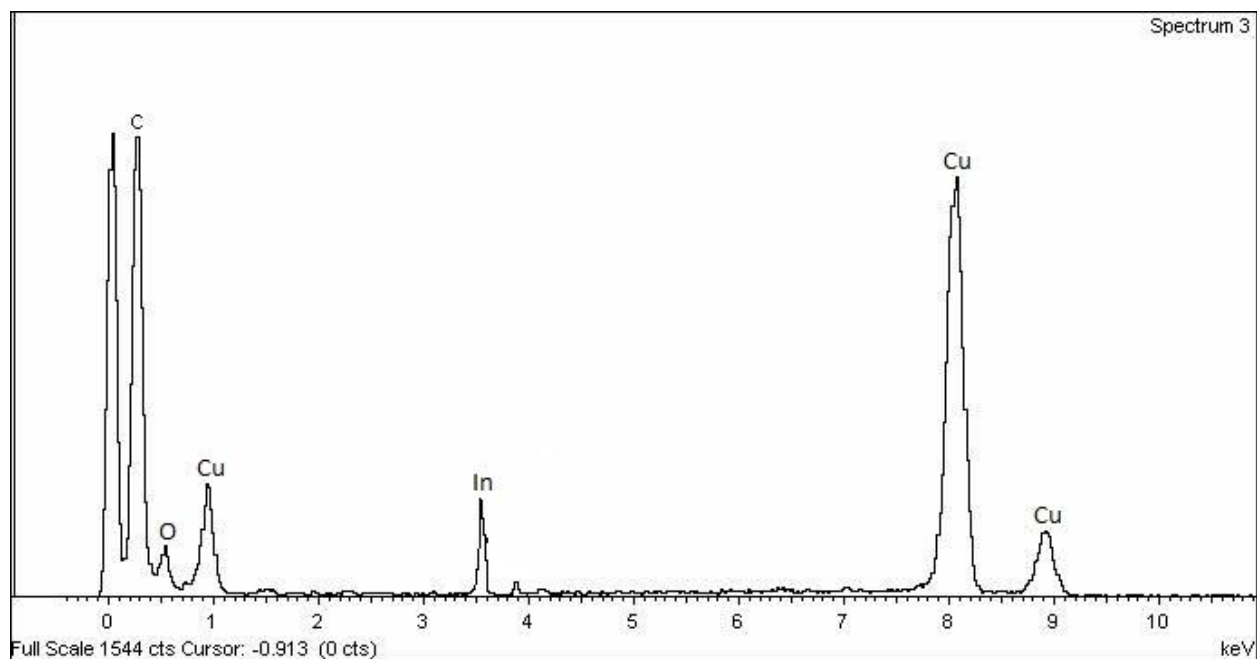


Figure S10:- The EDS pattern of the InN nanocrystal sample prepared with OLA:OA = 3:1

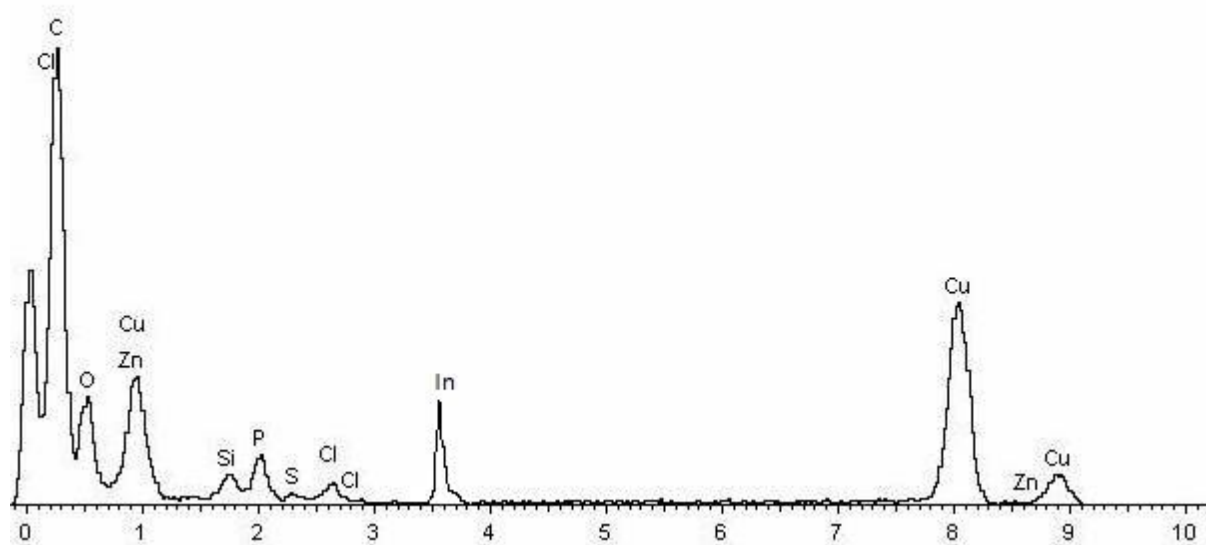


Figure S11:- The EDS pattern of the InN nanocrystal sample prepared with OLA:OA = 5:1

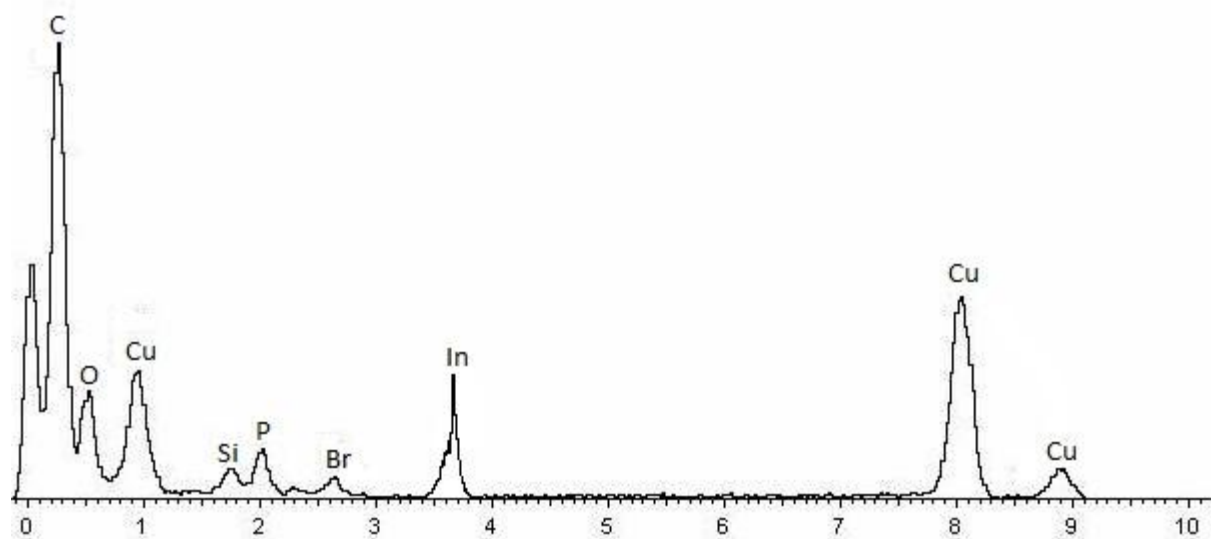


Figure S12:- The EDS pattern of the InN nanocrystal sample prepared with OLA:OA = 7.5:1

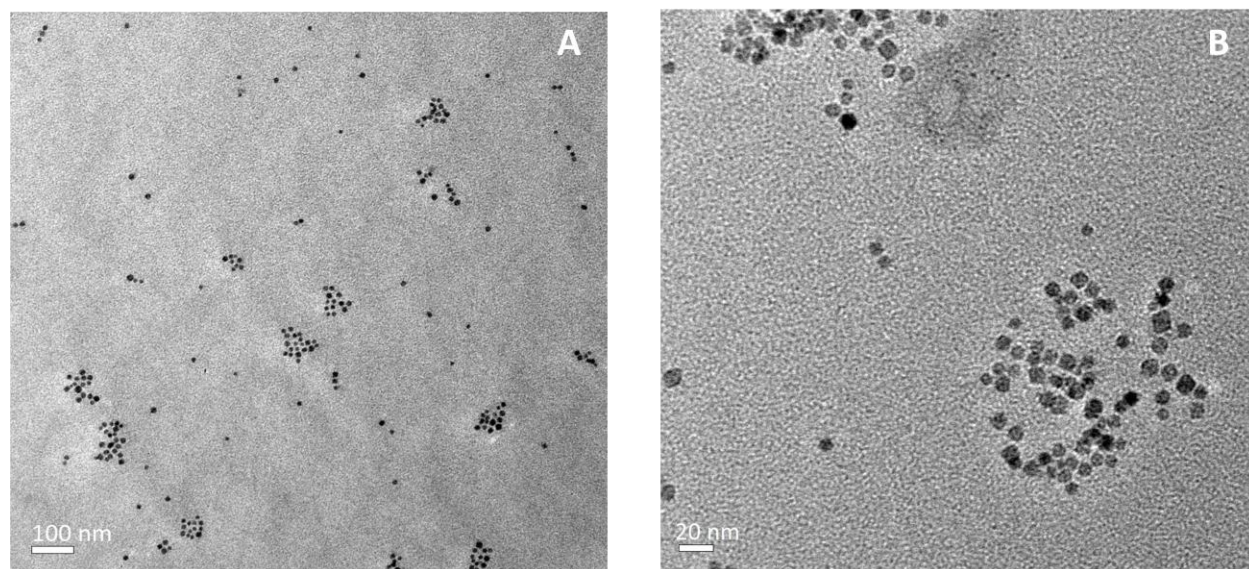
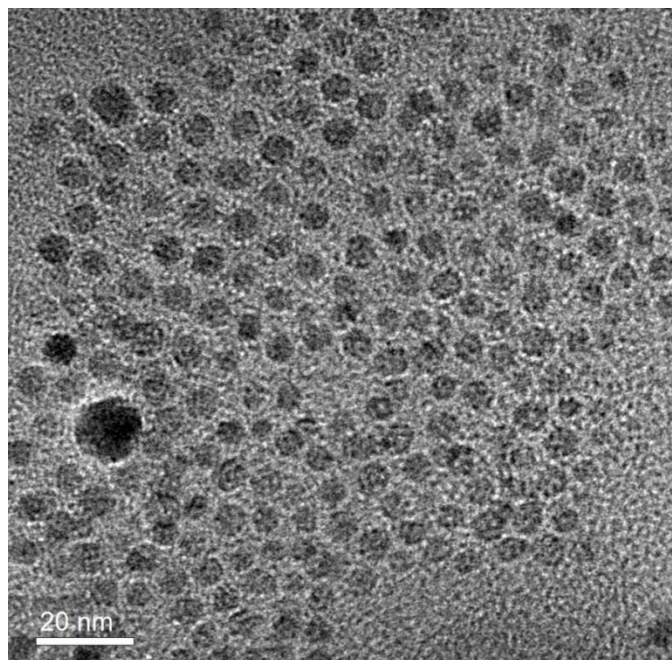


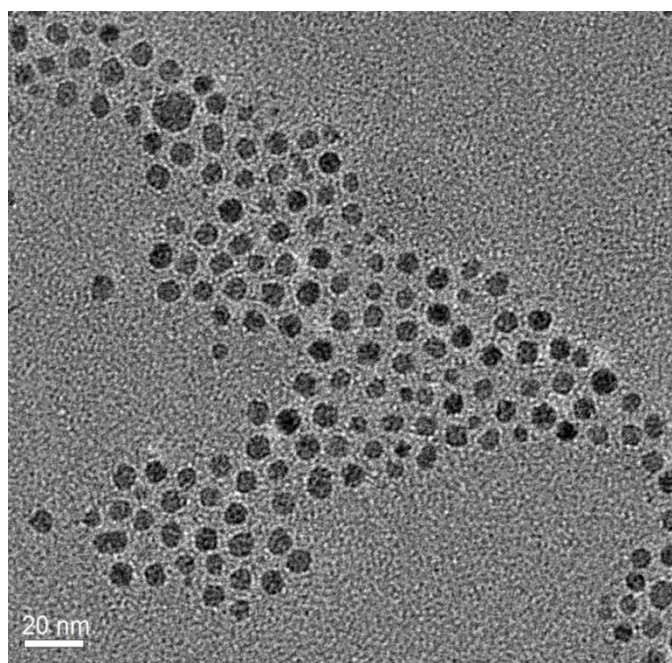
Figure S13:- TEM images of the nanocrystals taken from the end product synthesized using excess TMEDA. The average radius of the nanocrystals was  $\sim 4.53$  nm



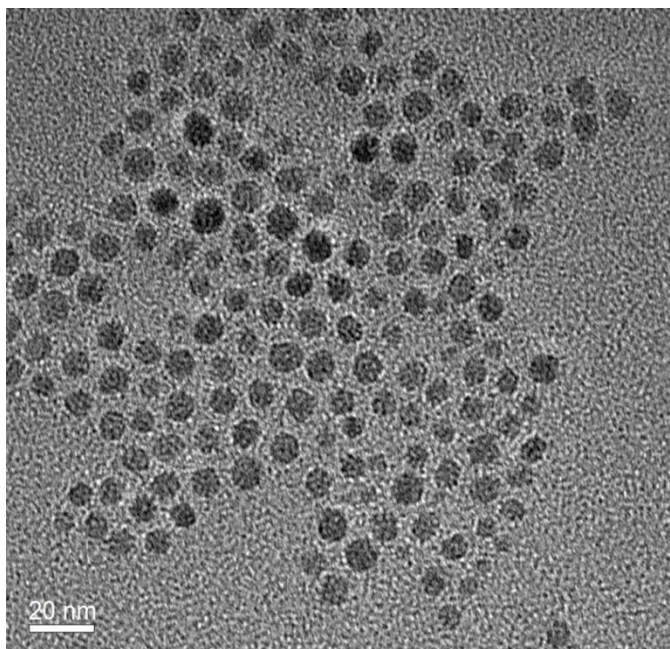
**TEM Images;** Figure S14:- InN nanoparticles made using OLA:OA=10:1



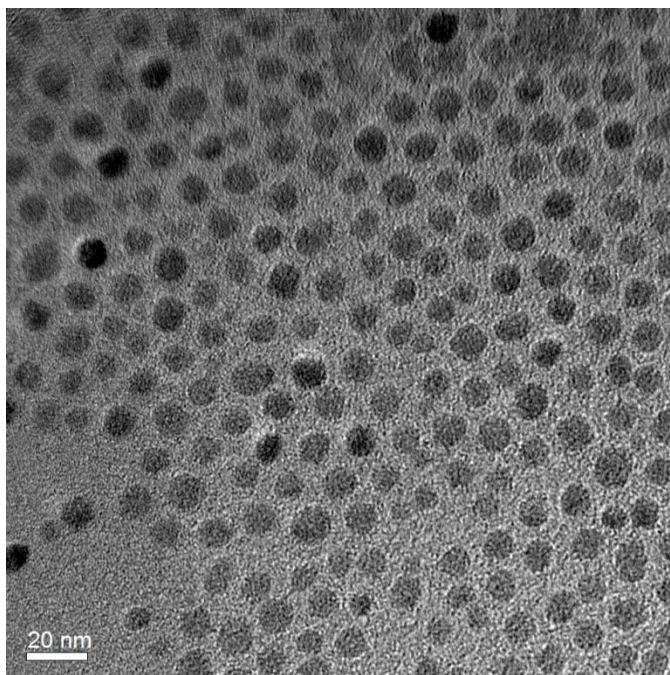
**Al 1; 129/42 = 3.07 nm**  
**Avg Size :-  $3.066 \pm 0.937$  nm**



**Al 2; 490/145 = 3.38 nm**  
**Avg. Size :-  $3.376 \pm 1.145$  nm**

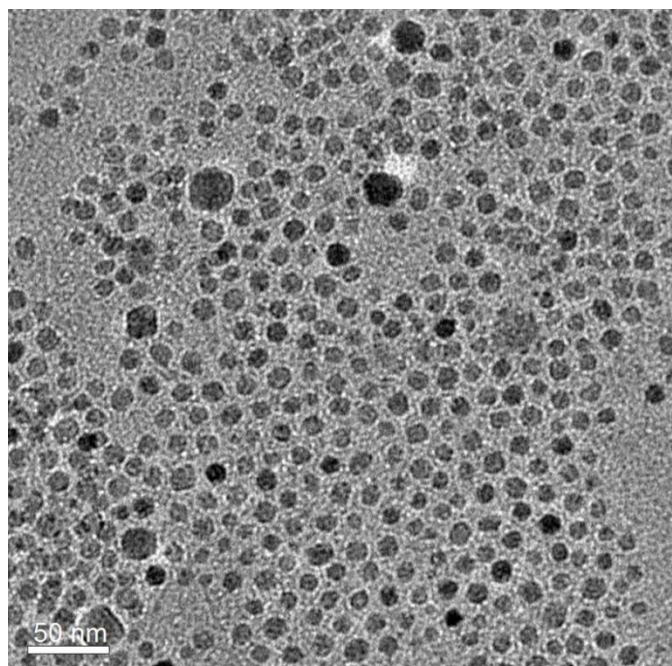


**Al 3:-  $368/102 = 3.6$  nm**  
**Avg. Size ;  $3.602 \pm 1.307$  nm**

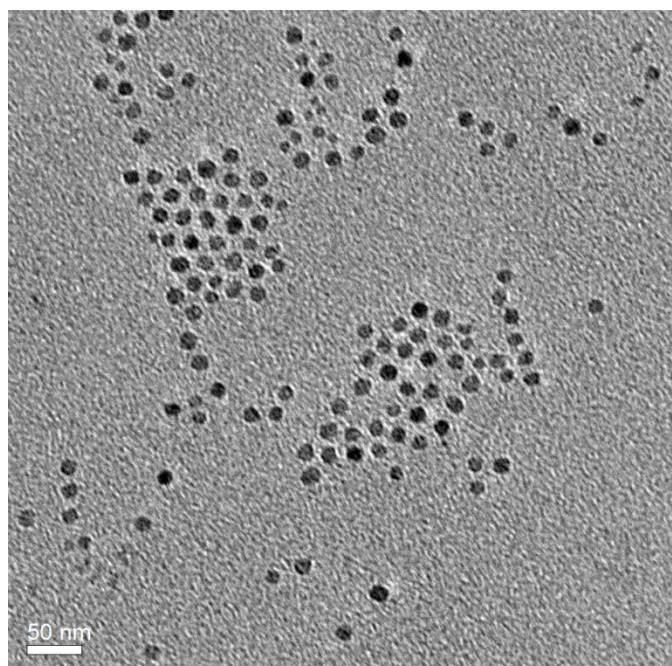


**Al 4:-  $297/59 = 4.95$  nm**  
**Avg. Size;  $4.952 \pm 0.816$  nm**





**Al 5:-  $923/162 = 5.70$  nm**  
**Avg. Size;  $5.708 \pm 2.203$  nm**



**Al 6:-  $820/137 = 5.98$  nm**  
**Avg. Size ;  $5.989 \pm 2.121$  nm**

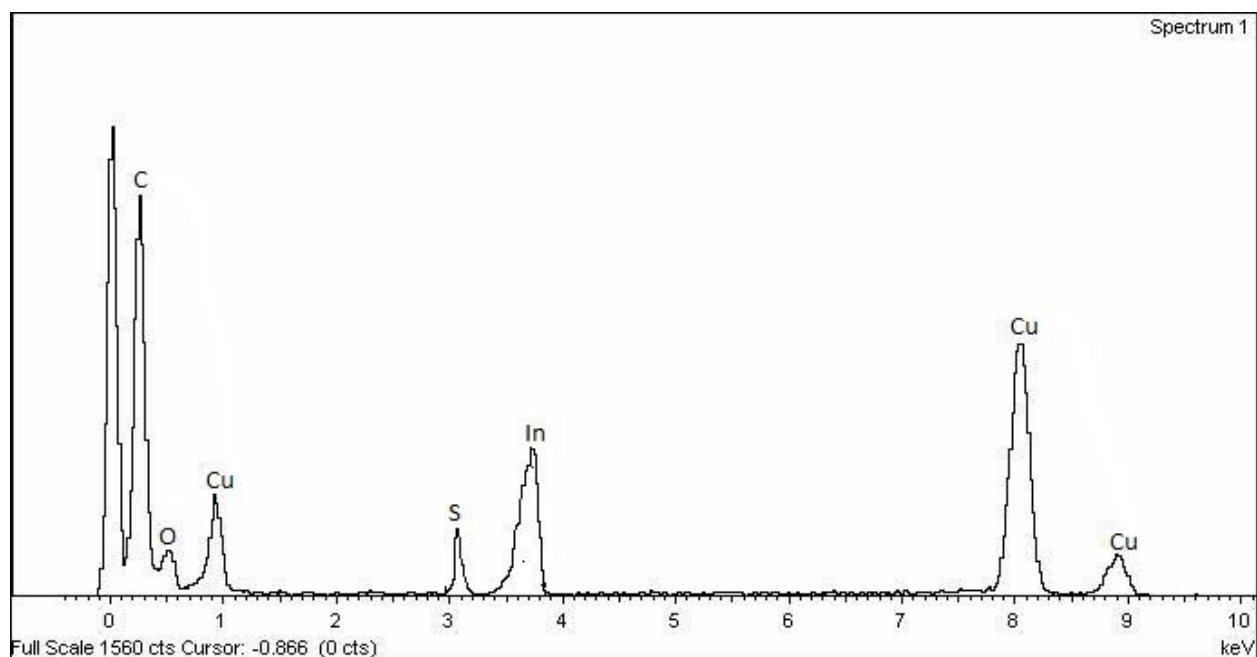


Figure S16:- The EDS pattern of the InN nanocrystal sample prepared with OLA:OA = 10:1

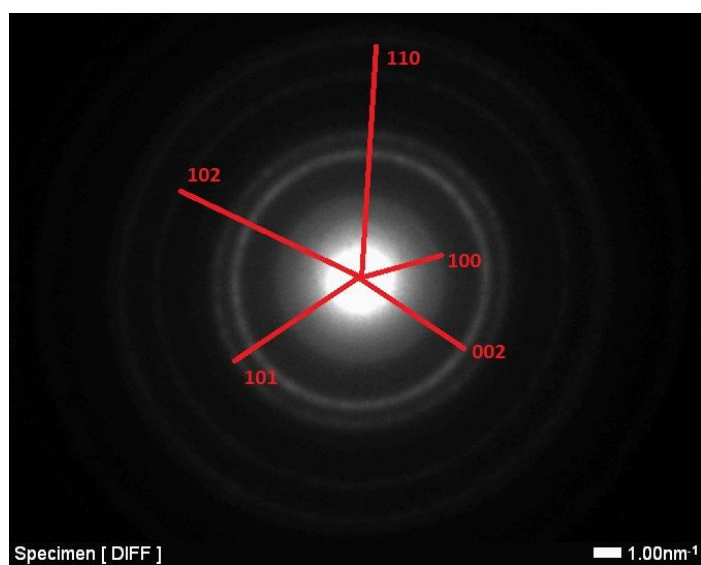


Figure S17:- SAED pattern of InN nanoparticles synthesized using OLA:OA=10:1

The pattern supports the wurtzite crystal phase of the particles.



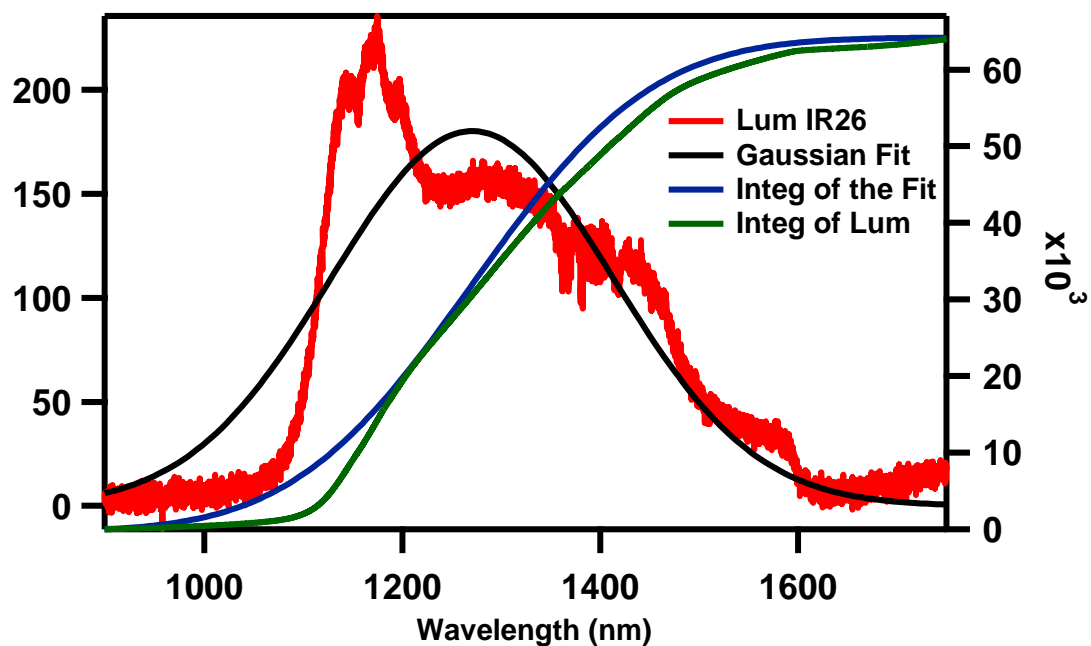


Figure S18:- Emission spectra (red) of IR26 in DCM. The black line is the Gaussian fit to the emission peak. The green and blue lines are the integration of the emission peak and the Gaussian fit respectively. For calculation of QY the second one has been used.

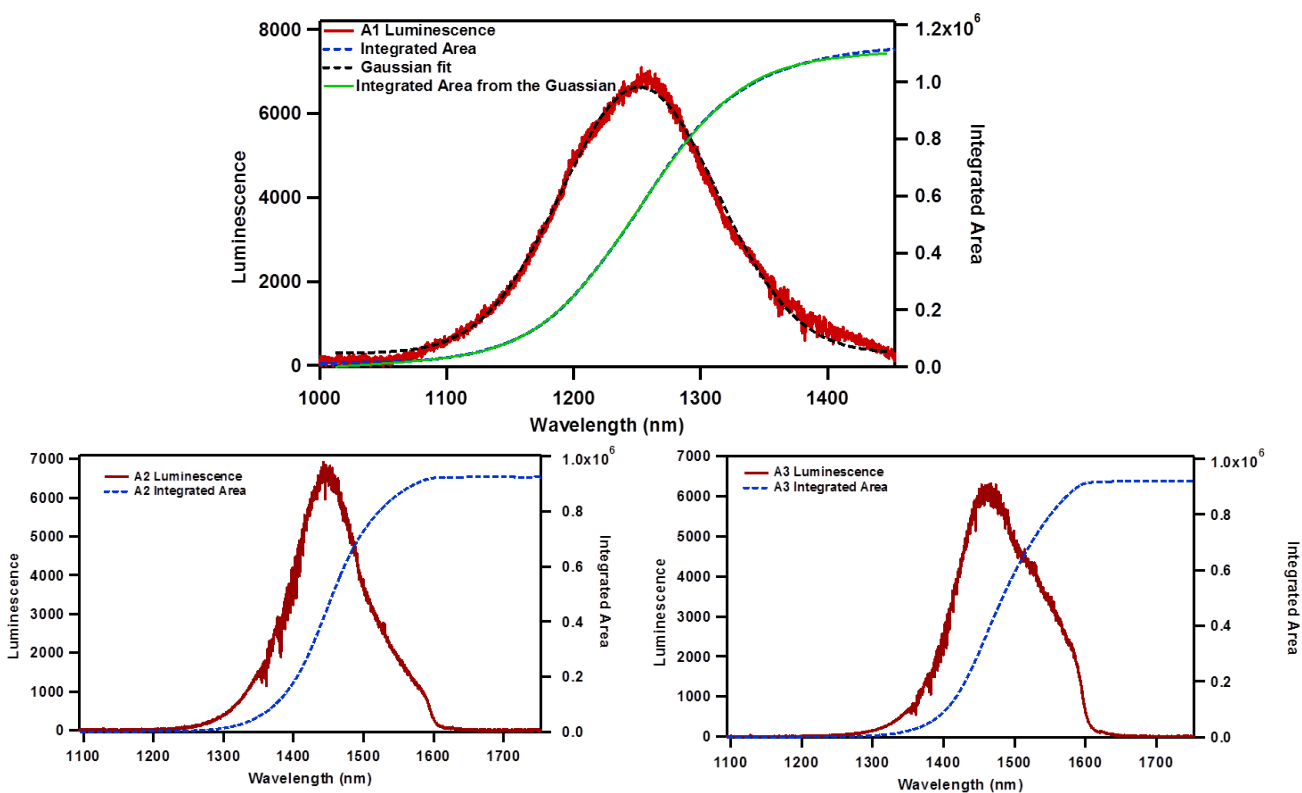


Figure S19:- Luminescence signal from the different aliquots from the InN sample prepared using OLA:OA=3:1 ratio

Sample	Abs	Lum Integ area
A1	0.30	$1.1143 \times 10^6$
A2	0.271	$9.2512 \times 10^5$
A3	0.275	$9.195 \times 10^5$
IR-26 dye	0.7369	$3.21 \times 10^6$

Table listing the luminescence integrated area and absorbance values for the aliquots from InN synthesis using OLA:OA = 3:1 ratio.

Following are the luminescence quantum yield (QY) calculation for the different aliquots from the InN sample prepared using OLA: OA=3:1 ratio

$$\Phi_x = 0.05 \times \frac{A_x}{A_s} \times \frac{F_s}{F_x} \times \left( \frac{\eta_x}{\eta_s} \right)^2$$

$$\text{A1 } \Phi = 0.05 \times \frac{1.1143 \times 10^6}{3.21 \times 10^6} \times \frac{0.7369}{0.300} \times 1.117 = 0.0477 \quad \text{QY} = \mathbf{4.77\%}$$

$$\text{A2 } \Phi = 0.05 \times \frac{9.2512 \times 10^5}{3.21 \times 10^6} \times \frac{0.7369}{0.271} \times 1.117 = 0.0438 \quad \text{QY} = \mathbf{4.38\%}$$

$$\text{A3 } \Phi = 0.05 \times \frac{9.195 \times 10^5}{3.21 \times 10^6} \times \frac{0.7369}{0.275} \times 1.117 = 0.0428 \quad \text{QY} = \mathbf{4.28\%}$$

Following are the luminescence quantum yield (QY) calculated similarly as above for the different aliquots from the InN sample prepared using OLA:OA=10:1 ratio

$$\Phi_x = 0.05 \times \frac{A_x}{A_s} \times \frac{F_s}{F_x} \times \left( \frac{\eta_x}{\eta_s} \right)^2$$

$$\text{A1 } \Phi = 0.05 \times \frac{4.3 \times 10^5}{6.42 \times 10^4} \times \frac{0.7369}{0.12657} \times 1.117 = 0.0218 \quad \text{QY} = \mathbf{2.18\%}$$

$$\text{A2 } \Phi = 0.05 \times \frac{2.188 \times 10^6}{6.42 \times 10^4} \times \frac{0.7369}{0.3019} \times 1.117 = 0.0465 \quad \text{QY} = \mathbf{4.65\%}$$

$$\text{A3 } \Phi = 0.05 \times \frac{9.803 \times 10^5}{6.42 \times 10^4} \times \frac{0.7369}{0.23935} \times 1.117 = 0.02672 \quad \text{QY} = \mathbf{2.67\%}$$

$$\text{A4 } \Phi = 0.05 \times \frac{1.711 \times 10^6}{6.42 \times 10^4} \times \frac{0.7369}{0.27739} \times 1.117 = 0.03956 \quad \text{QY} = \mathbf{3.96\%}$$