

Ratiometric Temperature Imaging Using Single Environment-Insensitive Luminescence of Mn-Doped Core/Shell Nanocrystals

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Supporting information:

1. Synthesis of nanocrystals

Mn-doped CdS/ZnS core/shell nanocrystals (NCs) were synthesized following the procedures published elsewhere.¹⁻³ The key control in the synthesis of Mn-doped CdS/ZnS NCs was to dope Mn²⁺ at the desired location and doping concentration using layer-by-layer synthesis method and some modification. CdS core NCs were synthesized by injecting 2.0 mL of sulfur 1-Octadecene (ODE) solution (0.25 M) to the 12.0 mL of CdO (125 mg) ODE solution which was mixed with oleic acid (2.02 g) at 250 °C. After the injection, the temperature was decreased to 240 °C for the growth. Once the desired size was achieved, the reaction was quenched by lowering the temperature. The reaction was processed under the nitrogen condition. Acetone was added to precipitate the NCs. The precipitant was dissolved with toluene, and then washed with methanol twice to remove the organic surfactants. To dope Mn²⁺ on the surface of the CdS core NPs, manganese diethyldithiocarbamate in oleylamine (OAm)

was added to the CdS NCs dissolved in toluene at 220 °C. After 20 min, the mixture was cooled to RT. The Mn-doped NCs were precipitated with acetone, and then rinsed with toluene and methanol. ZnS shell coating was achieved by injecting zinc stearate in toluene and sulfur in ODE alternately to the mixture of Mn-doped CdS NP NCs, OAm, and ODE at 220 °C. After coating ZnS shells to the desired thickness (~2.1 nm), the solution was cooled to RT and washed following the same procedure as the CdS core NCs.

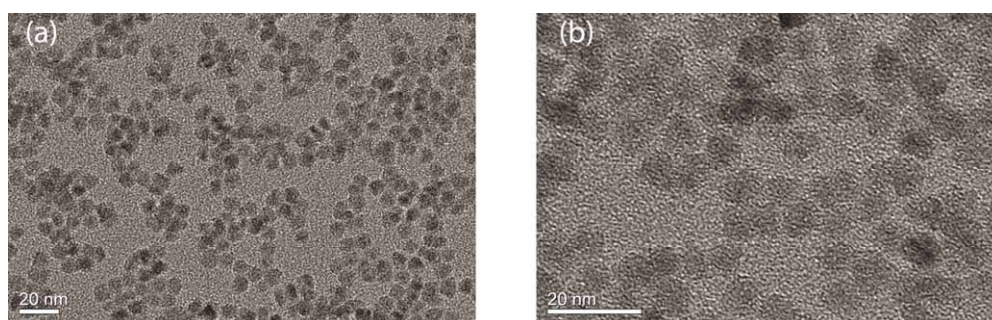


Figure S1. Transmission electron micrograph for the Mn-doped CdS/ZnS NCs (a) 100k and (b) 250k magnification.

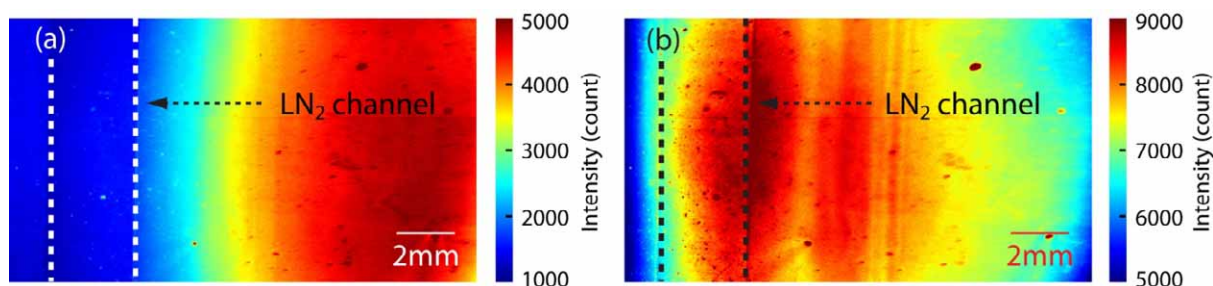


Figure S2. Color contour plot of the intensity images from the device using (a) 600 nm (b) 650 nm bandpass filter respectively with liquid nitrogen flow in the channel.

References:

1. Yu, W. W.; Peng, X., Formation of High-Quality CdS and Other II–VI Semiconductor Nanocrystals in Noncoordinating Solvents: Tunable Reactivity of Monomers. *Angew. Chem. Int. Ed.* **2002**, *41*, 2368-2371.
2. Yang, Y.; Chen, O.; Angerhofer, A.; Cao, Y. C., Radial-Position-Controlled Doping in CdS/ZnS Core/Shell Nanocrystals. *J. Am. Chem. Soc.* **2006**, *128*, 12428-12429.
3. Chen, H.-Y.; Maiti, S.; Son, D. H., Doping Location-Dependent Energy Transfer Dynamics in Mn-Doped CdS/ZnS Nanocrystals. *ACS Nano* **2011**, *6*, 583-591.