Materials List for:

Compact Quantum Dots for Single-molecule Imaging

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Materials

Name	Company	Catalog Number	Comments
Selenium	Sigma-Aldrich	229865	
Tri-n-octylphosphine	Strem	15-6655	97% pure, unstable in air
Cadmium oxide	Sigma-Aldrich	202894	Highly toxic: use caution
Tetradecylphosphonic acid	PCI Synthesis	4671-75-4	
Octadecene	Alfa Aesar	L11004	Technical grade
Hexadecylamine	Sigma-Aldrich	H7408	
Diphenylphosphine	Sigma-Aldrich	252964	Pyrophoric
Mercury acetate	Sigma-Aldrich	456012	Highly toxic: use caution
1-Octanethiol	Sigma-Aldrich	471836	Strong odor
Oleic acid	Sigma-Aldrich	W281506	
Zinc acetate	Alfa Aesar	35792	
Cadmium acetate hydrate	Sigma-Aldrich	229490	Highly toxic: use caution
Oleylamine	Fisher Scientific	AC12954	Unstable in air
Sulfur	Sigma-Aldrich	344621	
Trioctylphosphine oxide	Strem	15-6661	99%
Pyridine	VWR	EM-PX2012-6	Anhydrous
Thioglycerol	Sigma-Aldrich	M1753	Strong odor
Triethylamine	Sigma-Aldrich	471283	Anhydrous
Dialysis tubing	Spectrum Labs	131342	20 kDa cutoff
Centrifugal filter	Millipore	UFC801024	10 kDa cutoff
Monoamino-PEG	Rapp Polymere	12 750-2	750 Da
DMTMM, 4-(4,6-Dimethoxy-1,3,5-triazin-2-yl)-4-methylmorpholinium chloride hydrate	Alfa Aesar	H26333	
AKTAprime Plus Chromatography System	GE HealthCare		
Superose 6 10/300 GL chromatography column	GE HealthCare	17-5172-01	
Agarose, OmniPur	VWR	EM-2120	

Appendix

Synthesis of mercury octanethiolate: Slowly add a methanol solution of mercury acetate (1 eq.) to a stirring solution of 1-octanethiol (3 eq.) and potassium hydroxide (3 eq.) in methanol at room temperature. Isolate the mercury(II) octanethiolate precipitate via filtration, wash two times with methanol and once with ether, and then dry under vacuum.

Synthesis of multidentate polymer: Dissolve polyacrylic acid (1 g, 1,773 Da) in 25 ml dimethylformamide (DMF) in a 150 ml three-necked flask and bubble with argon for 30 min. Add an anhydrous solution of cysteamine (374 mg, 4.87 mmol) in 10 ml DMF. At room temperature with vigorous stirring, slowly add anhydrous diisopropylcarbodiimide (DIC, 736 mg, 5.83 mmol) over 30 min, followed by triethylamine (170 µl, 1.22 mmol), and allow the reaction to proceed for 72 hr at 60 °C. Add mercapt–thanol (501 mg, 6.41 mmol) to quench the reaction, and stir for 2 hr at room temperature. Remove DMF via rotary evaporation and isolate the polymer with the addition of a 2:1 mixture of ice-cold acetone:chloroform, followed by centrifugation. Dissolve the polymer in ~5 ml anhydrous DMF, filter, precipitate again with diethyl ether, and repeat. Dry the product under vacuum and store under argon.

Determination of CdSe core diameter: From the UV-Vis absorption spectrum determine the wavelength of the first exciton peak (λ, in nm), which is the longest-wavelength peak (*e.g.* roughly 498 nm for CdSe in **Figure 2a**), and use the sizing curve of Mulvaney and coworkers [12]:

$$D(nm) = 59.60816 - 0.54736\lambda + 1.8873 \times 10^{-3}\lambda^2 - 2.85743 \times 10^{-6}\lambda^3 + 1.62974 \times 10^{-9}\lambda^4$$

Determination of CdSe nanocrystal concentration: From a background-subtracted UV-Vis spectrum of an optically clear solution of CdSe nanocrystals, determine the absorption at 350 nm wavelength. Serial dilutions can be used to determine if the optical absorption is within the linear range of Beer's Law. The nanocrystal concentration (*QD*, in M) can be determined by plugging in the nanocrystal diameter (*D*, in nm), the optical absorption value (A_{3sa}), and the cuvette path length (*l*, in cm) into the following equation from the empirical correlation of Bawendi and coworkers [13]:

$$[QD](M) = 5.563\times10^{-5}\frac{A_{350}}{l(cm)\times D(nm)^3}$$