S1. Nanorod Synthesis and Quantification

CdSe/CdS seeded nanorod synthesis was adapted from procedures published by Carbone *et al*[1] and Talapin *et al*,[2] and size control was accomplished following the procedure of Jain *et al*[3] and Bronstein *et al.*[4]

Chemicals and Synthetic Apparatus: CdO (Alfa Aesar, 99.998%), octadecylphosphonic acid (PCI, 99%), hexylphosphonic acid (PCI, 99%), trioctylphosphine oxide (Strem, 99%), selenium powder (Sigma Aldrich, 99.99%), sulfur chunks (Alfa Aesar, 99.9995%), trioctylphosphine (Strem, 97%), octylamine (Sigma Aldrich, 99%) were used as-purchased. Hexanes and acetone, used in particle cleaning, were obtained from a solvent still and stored over molecular sieves inside an argon-filled glovebox. All reactions were done using standard Schlenck line procedures. The Schlenck line used in these procedures has an argon line flowing through a Drierite® drying chamber and a vacuum line with a roughing pump with stable vacuum pressure of 150 mTorr. All post-synthetic cleaning procedures were performed by mixing solvents in an argon-filled glovebox and centrifugation with argon-filled centrifuge tubes, though the centrifuge is outside the glovebox.

Synthesis of CdSe Seeds: CdSe seeds were prepared by mixing 60 mg of CdO with 280 mg of octadecylphosphonic acid and 3.0 g of trioctylphosphine oxide in a 50 mL 3-neck flask with a ½" octagonal magnetic stir-bar, a glass thermocouple adapter sealed with H-grease, and a silicone septum port. The mixture was heated to 150°C under vacuum for 30 minutes to degas, after which the flask is filled with argon and heated to 320°C for 1 hour, shaking occasionally to rinse all the CdO into the solution, until the solution is clear, and sometimes slightly yellow. After this complexation step, the solution is degassed at 150°C under vacuum for 1-2 hours, until the vacuum pressure recovers to 100 mTorr or lower. In an argon filled glovebox, 360 mg trioctylphosphine is stirred with 60 mg selenium powder for 1-2 hours, until the selenium has all dissolved. The three-neck flask is then heated to 380°C under argon, and 1.5 g of TOP is injected. After the temperature recovers to 380°C and with vigorous stirring (stir plate set at the highest setting) the TOP:Se mixture is injected from a 2 mL plastic syringe with a 2" 22 gauge needle. The reaction is allowed to proceed for 6 minutes after injection, after which the reaction mixture is allowed to cool by removing the heating mantle and blowing air over the flask. Once the reaction solution reaches 140°C, 5 mL of hexanes and 2.5 mL of octylamine are injected and the reaction mixture is brought into the glovebox. The particles are precipitated with acetone and methanol and centrifuged at 8000 rpm for 10 minutes. The supernatant is discarded and the particles are redispersed in hexanes, precipitated with acetone, and then centrifuged at 8000 rpm for 10 minutes, and the supernatant is discarded. The precipitate is dispersed in hexanes and stored in the glovebox. The particle size and concentration are determined from the wavelength and absorbance at the first exciton (at 572 nm) following the method of Yu et al.[5]

Seeded Growth of different sizes of CdSe/CdS rods*:* 500 mg CdO, 500 mg hexylphosphonic acid, 1450 mg octadecylphosphonic acid, and 15.0 g trioctylphosphine oxide are mixed in a 100 mL three-neck roundbottom flask with 1" octagonal stir bar, glass thermocouple adapter sealed

with H-grease, and silicone septum port. The mixture was heated to 150°C under vacuum for 1 hour to degas, followed by 3 pump/purge cycles with argon, allowing the pressure to recover to less than 200 mTorr each time. The flask is then switched to argon and heated to 320°C for 1 hour, shaking occasionally to rinse all the CdO into the flask, until the solution is clear. After this complexation step, the solution is degassed at 150°C under vacuum for 4 hours, until the vacuum pressure recovers to 150 mTorr or lower. In an argon filled glovebox, 6 identical solutions of TOP:S are prepared by heating 1.5 g trioctylphosphine with 120-125 mg sulfur for 1 hour at 100°C with stirring, until the sulfur has all dissolved. CdSe particles are dried under vacuum to remove hexanes and dispersed in the TOP:S solutions. Different quantities of nanoparticles are added to each solution to allow the growth of different sizes of nanorods, as shown in Table S1. The cadmium solution is held at 100°C under argon for several hours as all the reactions are done in series.

A 50 mL the three-neck flask with a ½" octagonal stir bar is held under vacuum and 3 mL of $Cd(ODPA)_2$+TOPO solution is added with a 3 mL syringe and a 5" 18 gauge needle. The flask is degassed by a few pump-purge cycles and then heated to 360°C under argon. With vigorous stirring (stir plate at the highest setting) the TOP:S+CdSe mixture is injected from a 10 mL plastic syringe with a 2" 22 gauge needle. The temperature of the solution drops to 330°C and is maintained at 330°C for 8 minutes. Then heating mantle is removed and the solution is allowed to cool to 140°C, at which point 3 mL of hexanes is injected and the solution is brought into the glovebox for cleaning. The solution is precipitated with acetone and centrifuged at 6000 rpm for 5 minutes. The supernatant is thrown away and the particles are redispersed in hexanes and precipitated again with acetone. The solution is centrifuged at 6000 rpm for 5 minutes. The particles are then redispersed in 3 mL of hexanes with 2 drops of octylamine. Later, the particles are stored at -20°C overnight to allow a white precipitate to form. The particles are then centrifuged at -20°C for 2 minutes at 4000 RPM and the supernatant is decanted.

Table S1

Moles of CdSe particles	Nanorod Length (nm)	Nanorod Width (nm)
16E-8	22 ± 2	4.5 ± 1.1
8E-8	37 ± 4	5.8 ± 1.4
4E-8	47 ± 3	6.0 ± 1.9
2E-8	90 ± 8	5.3 ± 1.4
1E-9	180 ± 13	13 ± 4

Nanorods were quantified by visualization on an FEI 20 Tecnai, and quantified using a custom plugin for ImageJ and subsequent fitting to a log normal curve using Igor Pro.

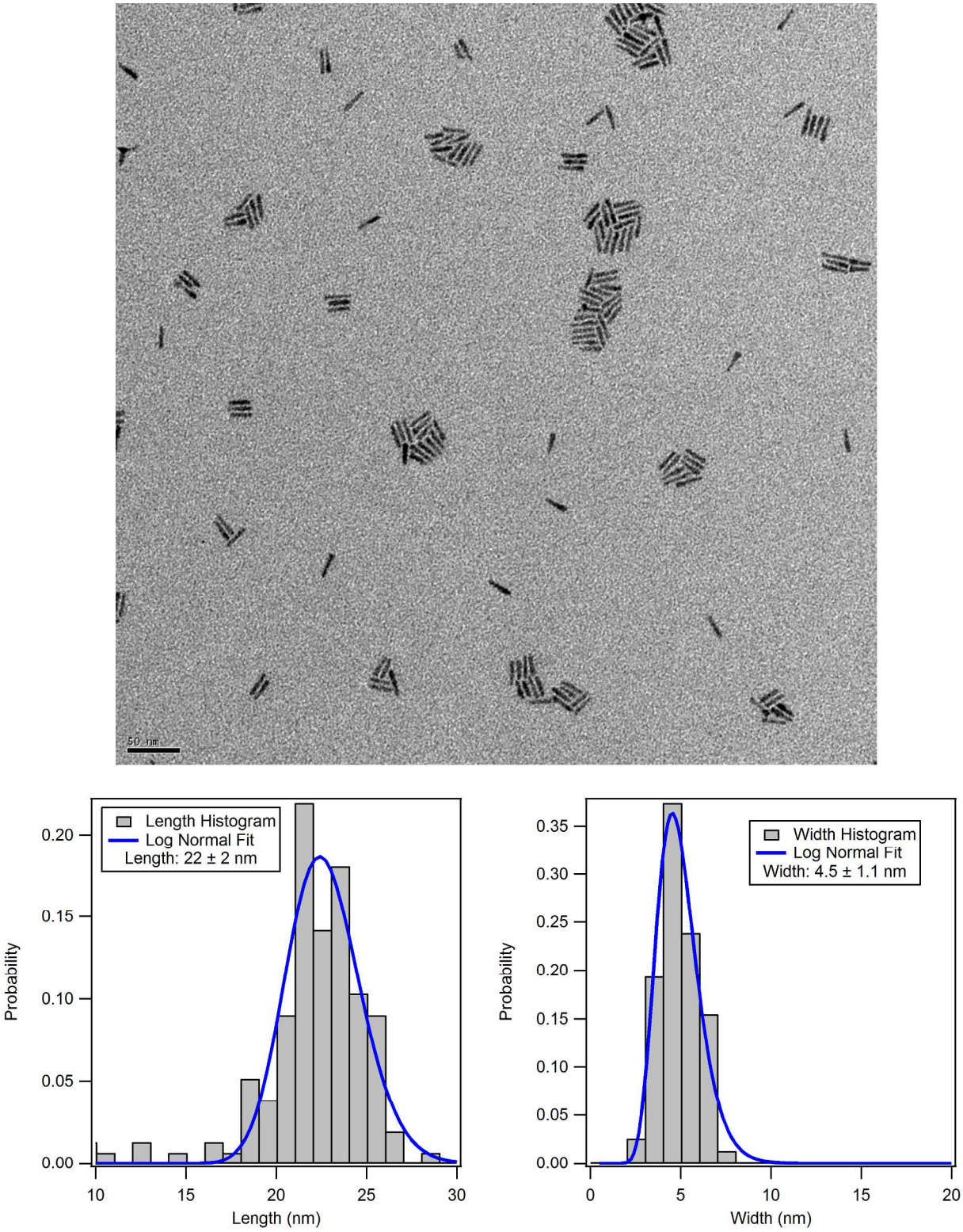

Figure S1: 22 nm nanorods. The TEM image (top) was quantified as described in section S1 to produce the length and width histograms (bottom).

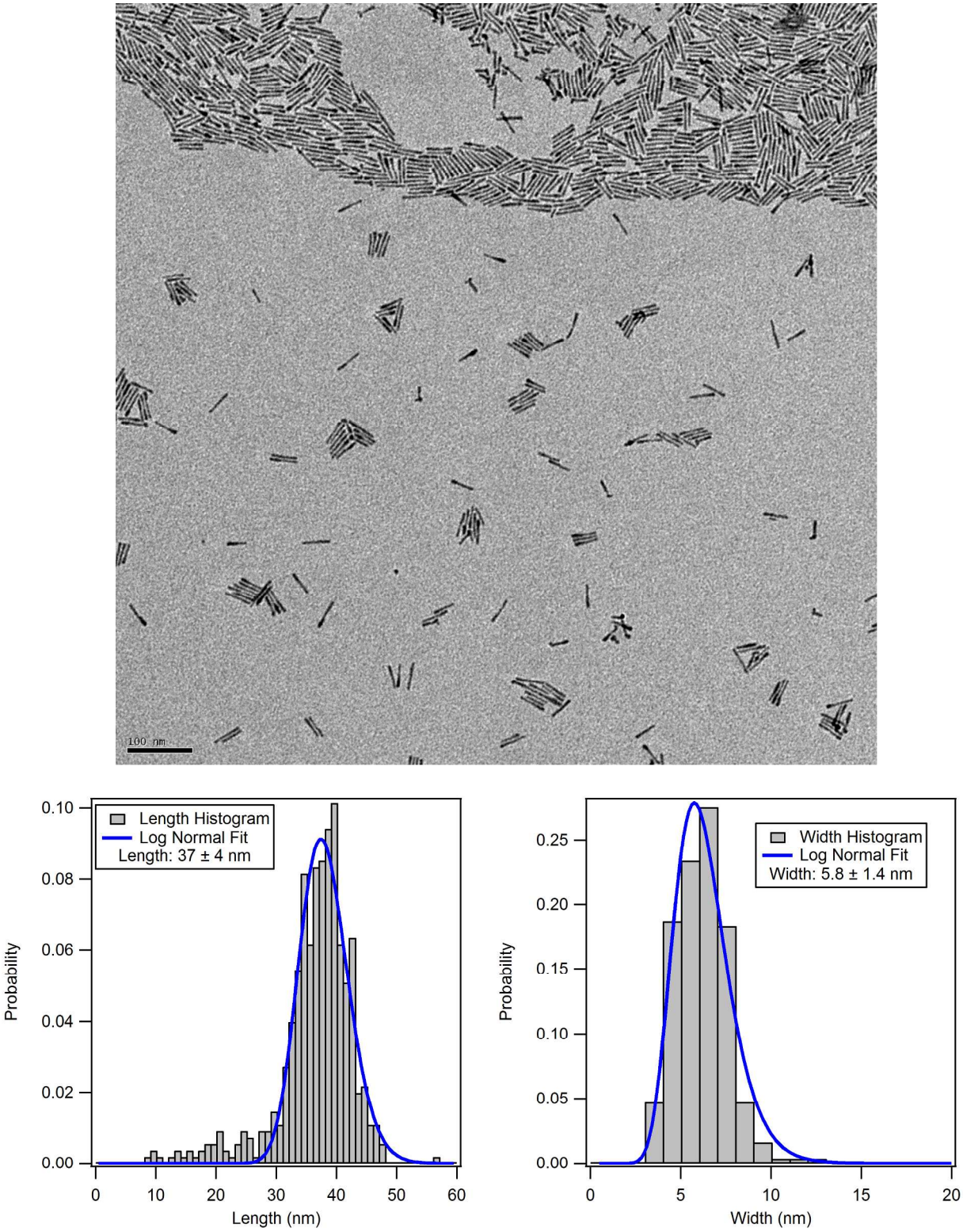

Figure S2: 37 nm nanorods. The TEM image (top) was quantified as described in section S1 to produce the length and width histograms (bottom).

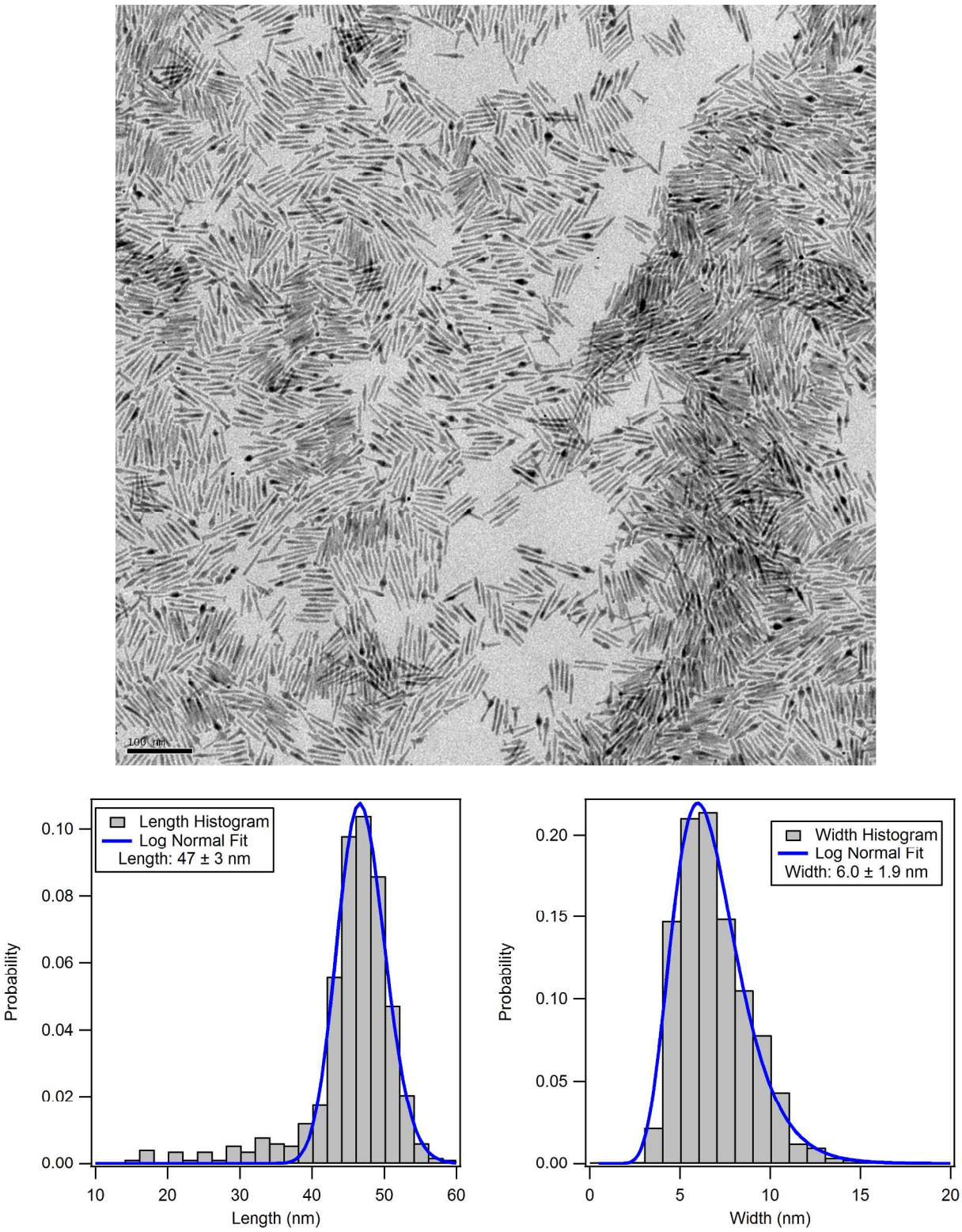

Figure S3: 47 nm nanorods. The TEM image (top) was quantified as described in section S1 to produce the length and width histograms (bottom).

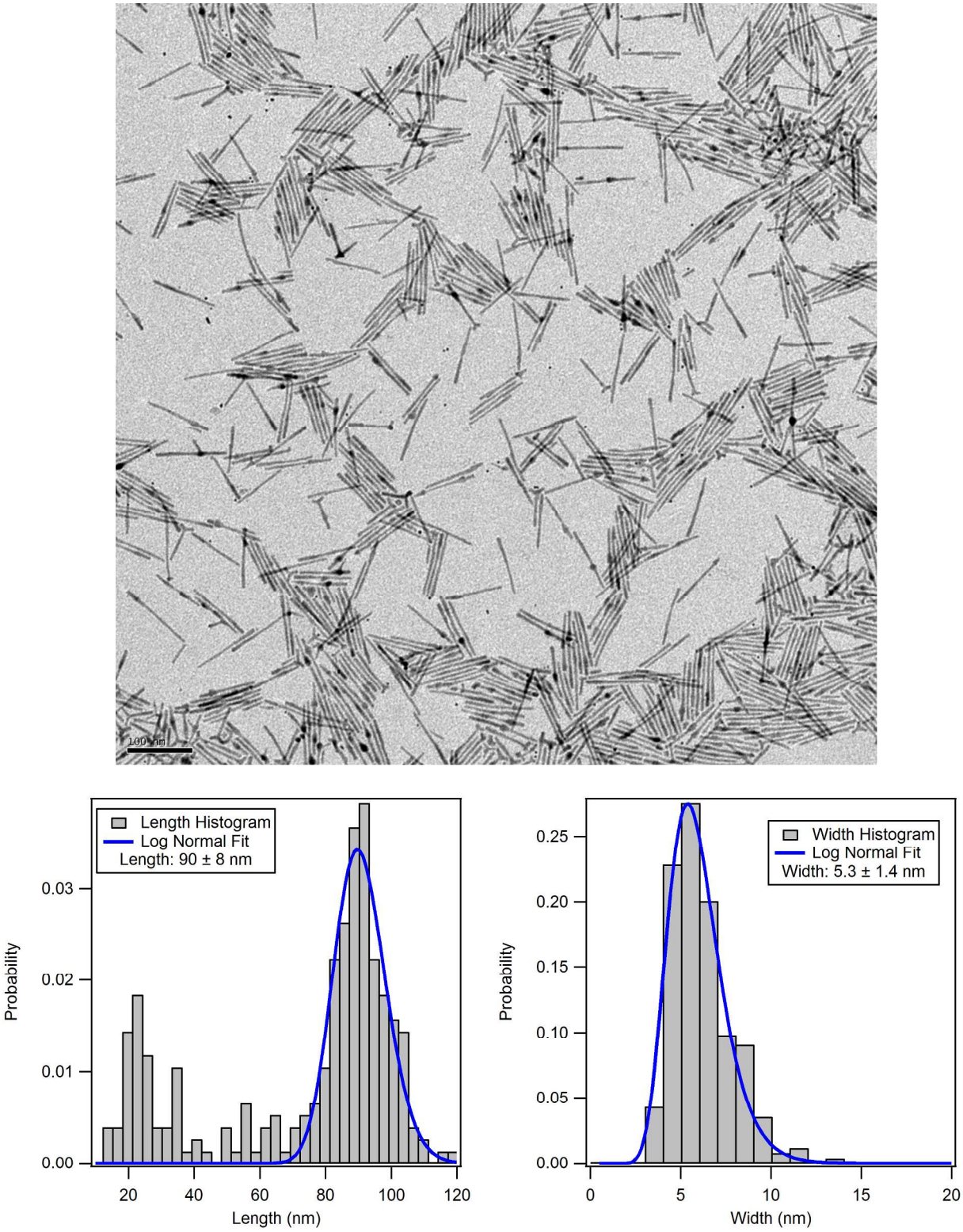

Figure S4: 90 nm nanorods. The TEM image (top) was quantified as described in section S1 to produce the length and width histograms (bottom).

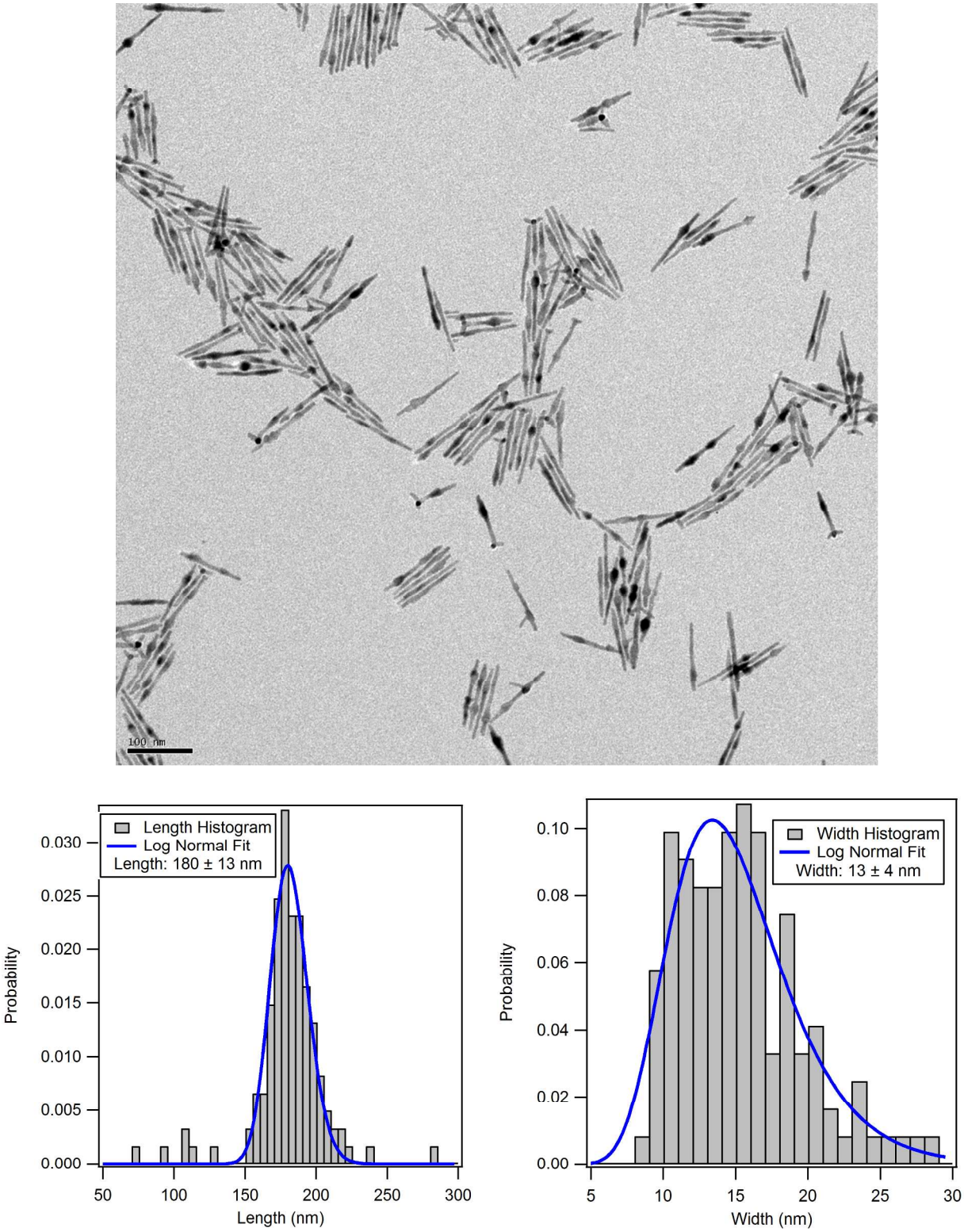

Figure S5: 180 nm nanorods. The TEM image (top) was quantified as described in section S1 to produce the length and width histograms (bottom).

S2. PS-*b*-P4VP(PDP)$_{1.7}$ without NRs

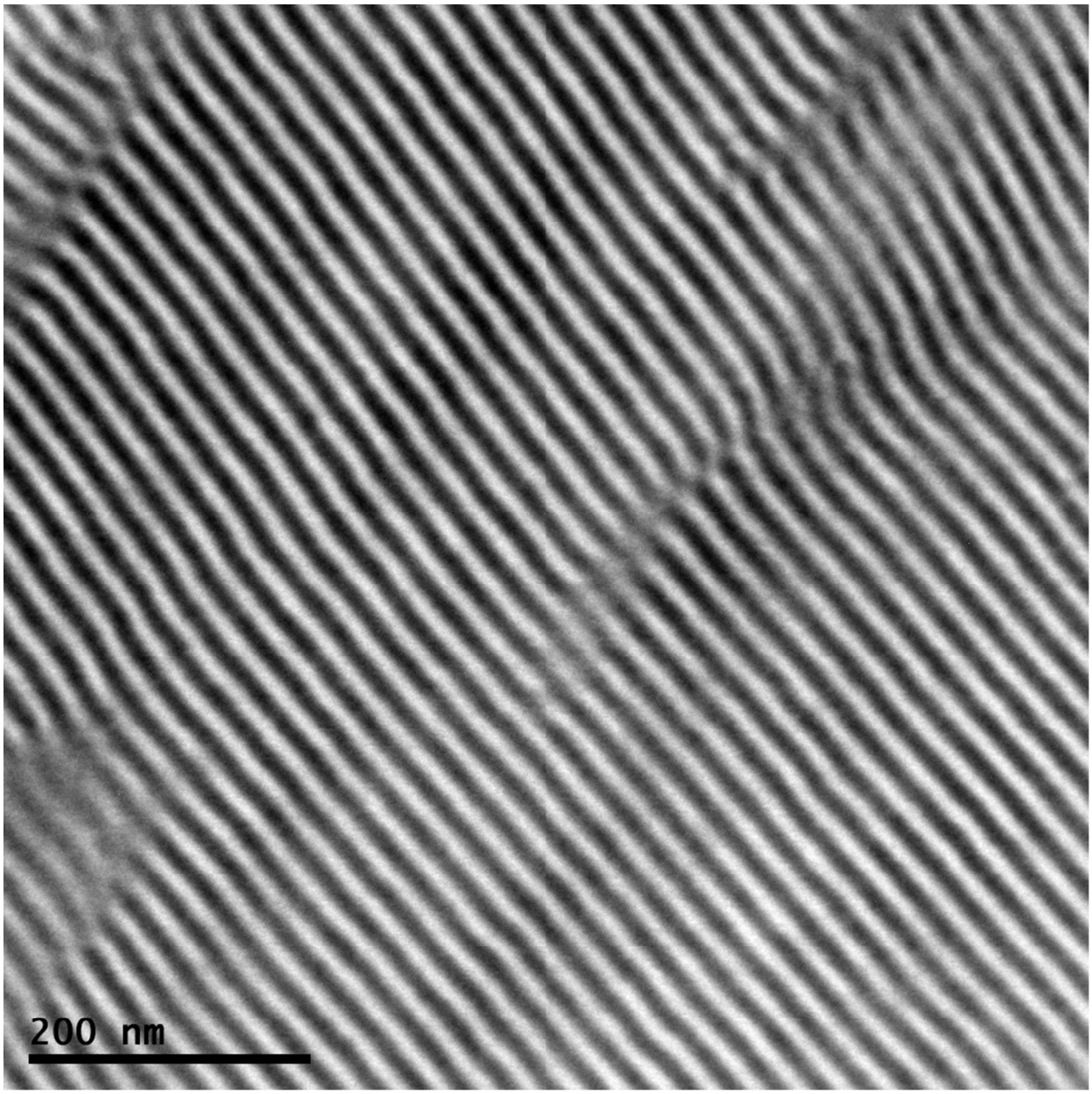

Figure S6: TEM image of PS-*b*-P4VP(PDP)$_{1.7}$ with no nanoparticles annealed at 150°C. P4VP(PDP)$_{1.7}$ domains were stained with iodine for contrast.

In Figure S6, a TEM image of a PS-*b*-P4VP(PDP)$_{1.7}$ sample containing no NRs or other nanoparticles and annealed at 150°C can be seen. The sample adopts a lamellar morphology after annealing, rather than the PS-cylinder morphology that results from annealing at lower temperatures or no annealing at all. This is due to the increased dissolution of PDP in the PS domains at elevated temperatures and incomplete recovery of dissolved PDP to the P4VP domains upon cooling.

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3. Jain, P. K.; Amirav, L.; Aloni, S.; Alivisatos, A. P., Nanoheterostructure Cation Exchange Anionic Framework Conservation. *Journal of the American Chemical Society* **2010**, 132, 9997-9999.
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