Electronic Supplementary Material (ESI) for Nanoscale Horizons.

Supplementary information:

The distributions used in this work are based on the normal distribution function which is a common statistical distribution described by the mean value μ and the standard deviation σ. Using the normal distribution the probability of finding a wire with length x is given by the function

$$P(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}} \quad (1)$$

In this work three different normal distributions were introduced, one for each imperfect characteristic represented in the system: wire length, wire angular distribution and wire radius of curvature. Each of the distributions was defined by the average value (average wire length L_w, average angle $0°$ and average radius of curvature R_c) and the standard deviations for each distribution were defined as σ_L, σ_a and σ_{rc}, in the following relations:

$$\sigma_L = \frac{D_L L_w}{4} \quad (2)$$

$$\sigma_a = \frac{(4 - D_a)\pi}{4} \quad (3)$$

$$\sigma_{rc} = \frac{L_w D_{rc}}{\pi 4} \quad (4),$$

where D_L, D_a and D_{rc} are the length, angular and radius of curvature distribution parameters, respectively. These distribution paramaters allow the control of each distribution such that when all the distribution parameters are 0 the simulation is identical to the ideal case, straight sticks of identical length with a uniform angular distribution.

Increasing the distribution parameters results in a perturbation on the ideal case introducing imperfections. For the angular distributions σ_a has been defined such that an increase in D_a results in the distribution approaching a delta function. The other two distributions start as delta functions and increasingly approach a uniform distribution.

Figure SI 1: A series of histograms of nanowire networks with different length distribution parameters D_L and their resultant networks. Wire length is 37.5 µm and the system size is 500 µm. Percolating cluster is indicated in blue. Examples of short, average and long nanowires are indicated with orange, green and red ellipses, respectively.

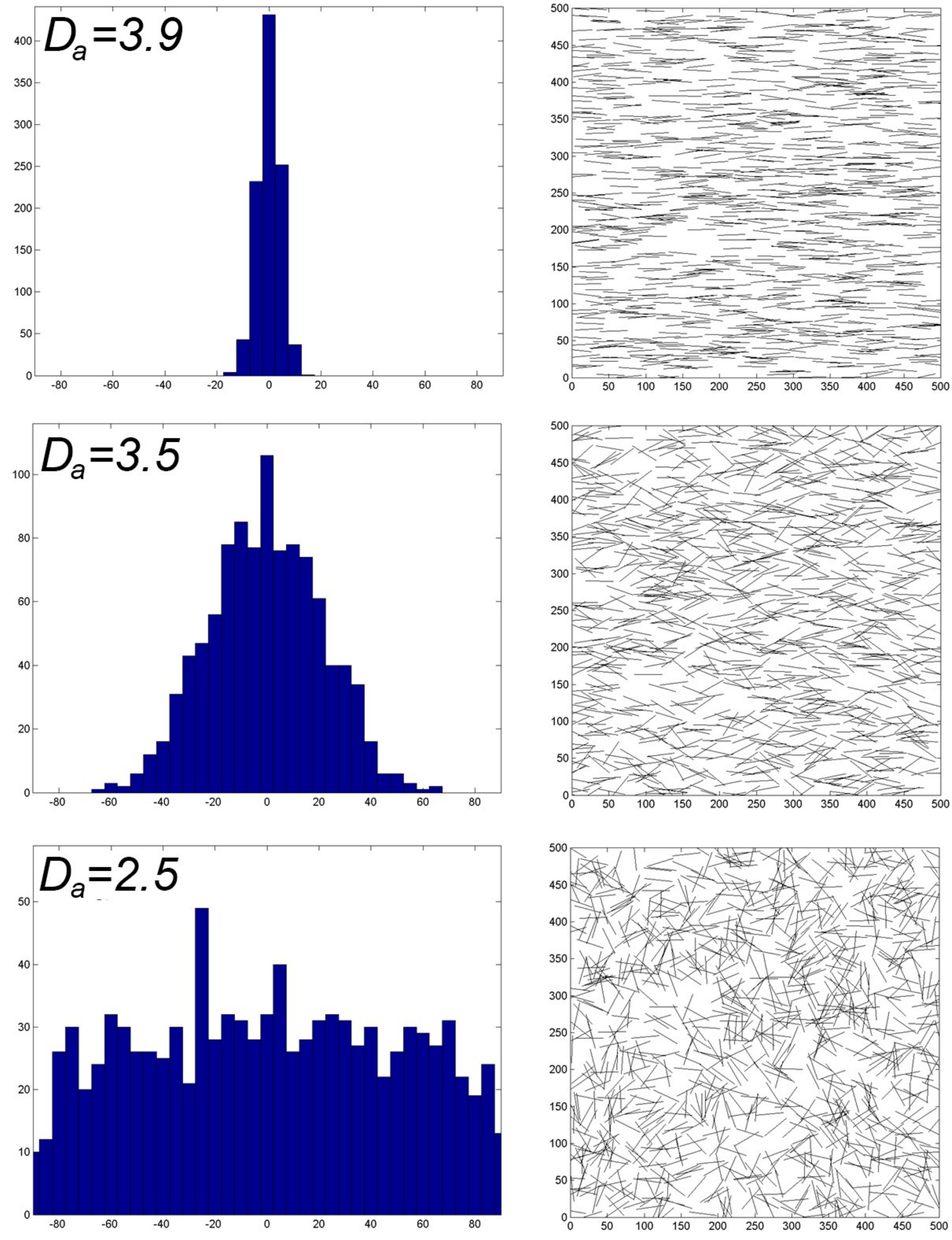

Figure SI 2: A series of histograms of nanowire angles for networks with different values of the angular distribution parameter D_a. As D_a decreases the angular distribution approaches uniform. Wire length is 37.5 μm and the system size is 500 μm x 500 μm.

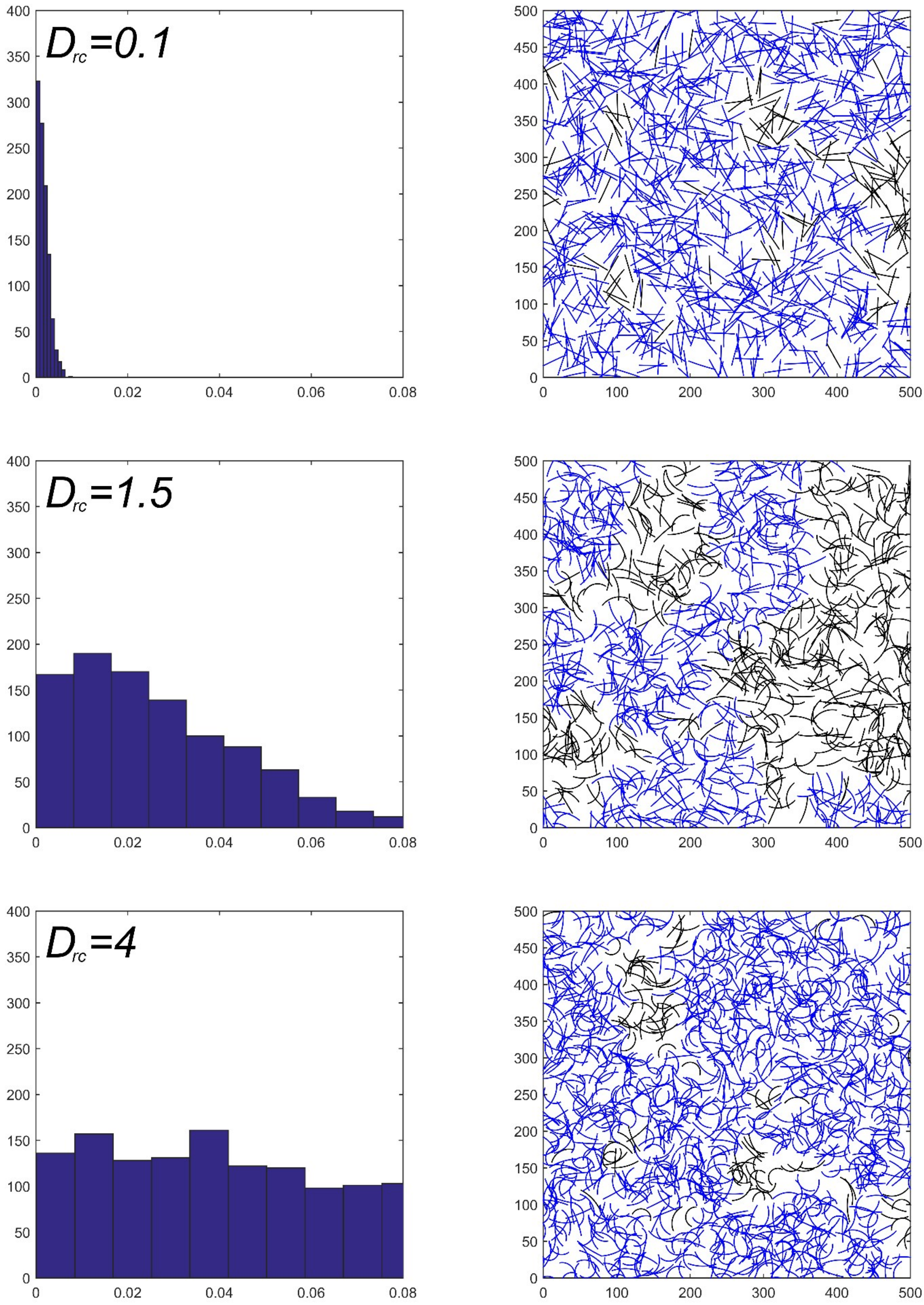

Figure SI 3: A series of histograms of nanowire curvature for networks with different values of the radius of curvature distribution parameter D_{rc} and their resultant networks.

Qualitative comparison of the simulations with imperfections to experimental data

In order to assess whether the assumptions made in our simulations were reasonable we extracted distribution parameters from an experimental AgNW network and used them to generate simulated networks. Representative images of the physical network and the simulations are shown in Figure SI 4. Assessment of the two images shows that the framework of the simulations consists of valid assumptions which allow us to produce simulated networks with features comparable to real ones.

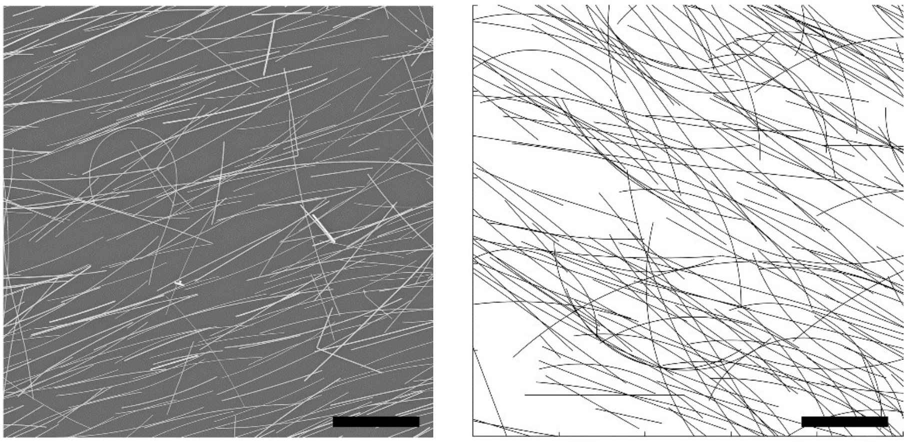

Figure SI 4: SEM Image of AgNW network on a silicon substrate (left). Simulated network with distribution parameters extracted from the real network (right). Scale bar in both images is 5 μm.

1. Dunn WL, Shultis JK. Exploring Monte Carlo Methods. Elsevier; 2011. 402 p.