Supporting Information

Self-Similar Interfacial Impedance of Electrodes in High Conductivity

Media: II. Disk Electrodes

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Nanorod Height Measurement



Figure S-6 SEM image of nanorods taken at a 45° angle with a depiction of nanorod viewing angle for height determination.

The average nanorod height was obtained from SEM images taken at 45 degree inclination at various locations on the electrode. The total height of the nanorod was calculated using trigonometry as shown in Fig S5. To obtain a statistically meaningful value, 46 fully exposed nanorod where the top and bottom could be easily ascertained were measured, resulting in an average total height of 210 ± 12 nm. The error value corresponds to the standard deviation of the measurements. The height of both the Au and Ni segments were calculated in the same manner as above and respectively are 105 ± 12 nm.

Surface Area Calculation

The surface enlargement factor was calculated using the standard unit cell for a hexagonal array as illustrated in Fig S7 a). Microscopy Image Segmentation Tool (MIST) software ³ statistically analyzes SEM images to determine the average diameter, center-to-center nanorod distance and unit cell area Fig S7 b).



Figure S-7 a) Unit cell diagram. b) SEM image of selected nanorods for MIST analysis. c) Unit cell area analysis. d) Effective nanorod diameter.

The average nanorod diameter (*d*) is 85 ± 8 nm and the average nanorod separation (*l*) of 21 ± 8 nm was calculated by subtracting the nanorod diameter from the center-to-center distance. The unit cell area (A_{unit}) (indicated with a red parallelogram) obtained by the MIST histogram is $9800\pm$ 550 nm² Fig S6 c). The area of the nanorod side ($A_{nanorod}$) 56100 ± 2100 nm² was calculated by multiplying the nanorod height by the circumference, which was calculated using the MIST diameter Fig 2 c). The surface enlargement factor (*C*) is calculated by:

$$C = \frac{A_{unit} + A_{nanorod}}{A_{unit}} \tag{1}$$

 $C = 6.71 \pm 0.40$ which is close to the experimentally obtained enlargement factor C = 6.51. The error is calculated at ~2.98%.



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