Title: Data associated with the manuscript: Influence of single-nanoparticle electrochromic dynamics on the durability and speed of smart windows.

Abstract: Nanomaterials have tremendous potential to increase electrochromic smart window efficiency, speed, and durability. However, nanoparticles vary in size, shape, and surface defects, and it is unknown how nanoparticle heterogeneity contributes to particle dependent electrochromic properties. Here, we use single-nanoparticle level electro-optical imaging to measure structure–function relationships in electrochromic tungsten oxide nanorods. Single nanorods exhibit a particle-dependent waiting time for tinting (from 100 ms to 10 s) due to Li-ion insertion at optically inactive surface sites. Longer nanorods tint darker than shorter nanorods and exhibit a Li-ion gradient that increases from the nanorod ends to the middle. The particle-dependent ion-insertion kinetics contribute to variable tinting rates and magnitudes across large-area smart windows. Next, we quantified how particle–particle interactions impact tinting dynamics and reversibility as the nanorod building blocks are assembled into a thin film. Interestingly, single particles tint 4 times faster and cycle 20 times more reversibly than thin films made of the same particles. These findings allow us to propose a nanostructured electrode architecture that optimizes optical modulation rates and reversibility across large-area smart windows.

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Format of data files – .tif, .csv, .m, .mat

Location where data were collected – Colorado State University, Dept. of Chemistry, Fort Collins, CO

Time period during which data were collected - 2017-10-07).

File Information – The raw unanalyzed images in this manuscript are provided here as a .tiff image stack. A Matlab script (.m) and workspace file (.mat) are provided to analyze the raw data. The metadata.txt file describes the variables in ProcessedWorkspace.mat.

Uncertainty, precision, and accuracy of measurements – The associated manuscript and .m file describe the calculation of the uncertainty in the measurements.

Method(s) – Transmission image stacks were acquired using an Andor EM-CCD camera.

Software – Matlab 2018b was used to analyze the dataset.

Date dataset was last modified

- Are there multiple versions of the dataset? no

Additional Notes: The .zip file contains the source code and associated data to process the raw image files in the Raw Image Files folder. The metadata.txt file describes the variables in ProcessedWorkspace.mat. The .m files are commented so that the user can reproduce the optical density trajectory analysis procedure.