Supporting Information for:

Phantom Electrons in Mesoporous Nanocrystalline SnO_2 Thin Films with Cation Dependent Reduction Onsets

Timothy J. Barr, Renato N. Sampaio, Brian N. DiMarco, Erica M. James, and Gerald J. Meyer*

Department of Chemistry, University of North Carolina at Chapel Hill,

Chapel Hill, North Carolina, 27599, United States

Supporting Information:

Derivation of Modified Beer's Law:

Expression	Explanation
$\Delta Abs = \varepsilon bc$	Beer's Law
$\Delta Abs = \varepsilon \left(\frac{h}{sin\theta}\right)\left(\frac{n}{A(dm^2)h(dm)}\right)$	Substitute $b = h/sin\theta$ and $c = n/(Ah)$ where n is moles of electrons, A is the geometric area of the cell, and h is the thickness. To hold the equality the units on A and h are dm^2 and dm, respectively.
$\Delta Abs = \varepsilon \left(\frac{h}{sin\theta}\right)\left(\frac{n}{A(dm^2)h(dm)}\right)\frac{(1000\ cm^3/L)}{(1000\ cm^3/L)}$	Multiply by $(1000\ cm^3/L)/(1000\ cm^3/L)$ to convert between cm^3 and L (or dm^3). The text in red is then combined to represent the Area and height of the film in cm^3, not L. This allows h to be canceled.
$\Delta Abs = \frac{1000\varepsilon}{sin\theta}\left(\frac{n}{A(cm^2)}\right)\left(\frac{F}{F}\right)$	Multiply by (F/F) to convert moles to Coulombs, C. Combine the text in red.
$\Delta Abs = \frac{1000\varepsilon}{Fsin\theta}\left(\frac{C}{A}\right)$	Final expression. Therefore, plotting ΔAbs vs C/A (A in cm^2) should give a straight line with a slope $m = \frac{1000\varepsilon}{Fsin\theta}$

b: Path length of sample probed by light

h: Film thickness

θ: Angle of film relative to light ray

A: Geometric area of the thin film