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A Study of Ionic Transport Through Randomly-Aligned Silica Nanospring Using Electrochemical Impedance Spectroscopy YUKTA P. TIMALSINA, JOSHUA BRANEN, ERIC ASTON, KEN NOREN, DAVID N. MCILROY, University of Idaho, Moscow, ID 83844 — A study of ionic transport through randomly aligned (silica) nanospring (RANS) using electrochemical impedance spectroscopy is presented. The device used for this study is a parallel plate capacitor consisting of two conducting surfaces with RANS as the dielectric spacer layer. The device response is evaluated with test solutions consisting of sodium chloride in a phosphate buffer. The experimental impedance data is analyzed using a model equivalent resistor-inductor-capacitor (RLC) circuit. The solution resistance through RANS and electric double layer formed at solution- electrode interface are elements of equivalent circuit that are more responsive and are more likely to be affected by changes of ionic concentrations. From our analysis we have determined that an electric double layer forms at the solution- RANS interface, which acts as a barrier to diffusion of ions from the solution into the RANS, and vice versa. We have also determined that ion diffusion is impeded by the RANS, as illustrated by changes in the resistance of the element of the equivalent circuit that corresponds to diffusion of ions through the RANS. The linear response of the RANS-based device below 10 kHz is potentially useful for many sensing applications.

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