Solid oxide fuel cells are capable of converting chemical energy into electrical energy with high efficiency from a variety of C/H containing fuels. Modeling of such fuel cells requires detailed understanding of the fundamental properties of the system. In this study, the capacitive behavior of the state-of-the-art anode material – the Ni/yttria stablized zirconia (YSZ) electrode – is investigated using structured thin film model electrodes.

It is shown that area specific capacitance (ASC) values are too high to be explained by a Helmholtz-type electrochemical double layer. A Gouy-Chapman type electrochemical double layer may explain the absolute value of the ASC, yet fails to explain the bias dependency of the capacitance. These facts and the dependency of the ASC on sulfur in the atmosphere indicate some sort of chemical capacitance. Potential types of chemical capacitances suggested in literature are discussed.