Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Electrochemical oxidation in solid oxide fuel cells – Where does it occur and how? ROBERT WALKER, Department of Chemistry and Biochemistry, University of Maryland, MICHAEL POMFRET, Department of Chemistry and Biochemistry, University of Maryland — Electrochemical processes in solid-oxide fuel cells (SOFCs) are thought to occur at a "triple phase boundary" (TPB) – that junction between a conducting anode, a solid oxide electrolyte and the gas phase fuel mixture. A quantitative, physical description of this boundary, however, remains elusive given difficulties associated with probing molecular species present in SOFCs under realistic operating conditions of high temperatures and reducing atmospheres. Recently, we have constructed an SOFC that has optical access to the anode assembly allowing us to probe with Raman spectroscopy the chemical intermediates present on anode and electrolyte surfaces as carbon containing fuels are electrochemically oxidized. Results show that chemistry occurs on both the anode and electrolyte surfaces as well as in the vicinity of the purported TPB. The reduced electrolyte surface is both catalytically active and, over micron distances, electrically conductive. The Ni anode shows strong evidence of adsorbed carboxylate intermediates. This talk will address mechanisms of electrochemical oxidation in SOFCs using direct and indirect experimental probes as well as the consequence of our findings for models of a well defined triple phase boundary.

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Date submitted: 30 Nov 2005 Electronic form version 1.4