Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

RuO_2/Pt Energy Harvesting Cells as Rechargeable Micropower Sources C. MARCEL BUFORD, US Naval Research Laboratory, KONRAD BUSSMANN TEAM, KAREN SWIDER-LYONS TEAM — We are studying electrochemical cells that are able to both continuously produce nanoWatts of power and supply microWatt-level bursts for microsensors and autonomous devices. The cells are constructed having a hydrous RuO_2positive electrode and a Pt negative electrode with characteristic open circuit voltage of ~ 0.4 V derived from the thermodynamic potential difference of the electrodes. Various electrolytes can be used, including H_2SO_4 and ionic conducting polymers (e.g. Nafion). When current is drawn from this galvanic cell, the cell is discharged and the voltage is reduced. After discharge, the circuit is opened and the cell returns to its characteristic voltage, appearing to "self-recharge." The phenomena causing the self-recharging of the positive and negative electrodes are known as potential recovery and self-discharge respectively. Previous studies cited in the literature have offered an explanation for the potential recovery of hydrous RuO_2, however, to date there exists no mechanism for the self-discharge of platinum. We will show that oxygen and low-levels of hydrogen harvested from the environment are electrochemically reduced and oxidized on the hydrous RuO_2 and Pt respectively recharging the cell. Recharging is a spontaneous process and has been shown to be reversible for up to 700 cycles. We will also show how the performance of the devices can be improved through the use of interdigitated thin film electrodes.

C. Marcel Buford
US Naval Research Laboratory

Date submitted: 01 Dec 2004 Electronic form version 1.4