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High-power-density catalyst induced hydrino transition (CIHT) electrochemical cell

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ABSTRACT

CIHT cells, each comprising a Mo, MoCu (50–50 at%), or MoNi (50–50 at%) hydrogen permeable membrane anode or tape cast CoCu, clad onto a hydrogen permeable Ni membrane, NiO cathode, a LiOH–LiBr eutectic mixture as the electrolyte, and MgO matrix in some cases, exploit hydrino formation as a half-cell reaction to serve as a new electrical energy source. The cells were operated under intermittent H₂O electrolysis to generate H at the anode and then discharged to form hydrinos wherein H₂O vapor as well as some O₂ was supplied from the atmosphere in open cells. Net electrical production over the electrolysis input and hydrogen supplied to the anode was measured to be multiples of the electrical input at about 10 mW/cm² anode area. The predicted molecular hydrino H₂(1/4) was identified as a product of CIHT cells by MAS ¹H NMR, electron-beam excitation emission spectroscopy, Raman spectroscopy, X-ray photoelectron spectroscopy, and photoluminescence emission spectroscopy.

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Introduction

Classical physical laws predict that atomic hydrogen may undergo a catalytic reaction with certain species, including itself, that can accept energy in integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2$ eV, wherein m is an integer. The predicted reaction involves a resonant, non-radiative energy transfer from otherwise stable atomic hydrogen to the catalyst capable of accepting the energy. The product is H(1/ p), fractional Rydberg states of atomic hydrogen called “hydrino atoms,” wherein $n = 1/2, 1/3, 1/4, \dots, 1/p$ ($p \leq 137$ is an integer) replaces the well-known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. Each hydrino state also comprises an electron, a proton, and a photon, but the field contribution from the

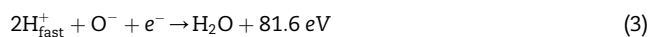
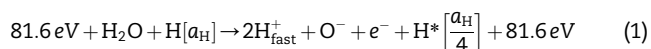
photon increases the binding rather than decreasing it, corresponding to energy desorption rather than absorption. A molecule that accepts $m \cdot 27.2$ eV from atomic H with a decrease in the magnitude of the potential energy of the molecule by the same energy may serve as a catalyst. The magnitude of the potential energy of H₂O is 81.6 eV [1]; so, the nascent H₂O molecule (not hydrogen bonded in solid, liquid, or gaseous state) may serve as a catalyst. Based on the 10% energy change in the heat of vaporization in going from ice at 0 °C to water at 100 °C, the average number of H bonds per water molecule in boiling water is 3.6 [1]; thus, H₂O must be formed chemically as isolated molecules with suitable activation energy in order to serve as a catalyst to form hydrinos. The catalysis reaction ($m = 3$) regarding the potential energy of nascent H₂O is

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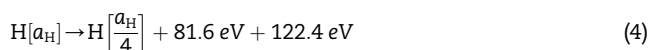
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And, the overall reaction is



The energy released to form hydrinos has been observed as continuum radiation in the 10–30 nm region and extraordinary fast H as reported previously [2]. In the present work, we show that the energy released by forming hydrinos according to Eqs. (1)–(4) gives rise to high-kinetic energy H. Using solid fuel Li + LiNH₂ + dissociator Ru–Al₂O₃ that can form H and HOH catalyst by decomposition of Al(OH)₃ and reaction of Li with H₂O and LiNH₂, ions arriving before m/e = 1 were observed by ToF-SIMS that confirmed the energy release of Eq. (4) is manifest as high kinetic energy H⁺. We also report that XPS was performed on the solid fuel comprising Li + LiNH₂ + dissociator [3], and molecular hydrino H₂(1/4) was confirmed as a product. The energy released to form hydrinos may ultimately be converted to thermal energy as measured calorimetrically on solid fuels [2–4] and may be utilized in Rankine-style electrical power plants [5,6]. An alternative, more elegant system is directed to a hydrino fuel cell called a CIHT (Catalyst-Induced-Hydrino-Transition) cell that generates an electromotive force (EMF) from the catalytic reaction of hydrogen to lower energy (hydrino) states providing direct conversion of the energy released from the hydrino reaction into electricity. Each CIHT cell shown schematically in Fig. 1 comprises a cathode, an anode, and an electrolyte that also serves as a source of reactants to form hydrinos. Due to oxidation-reduction half cell reactions, a hydrino-producing reaction mixture is constituted with the migration of electrons through an external circuit and ion mass transport through a separate internal path through the electrolyte to

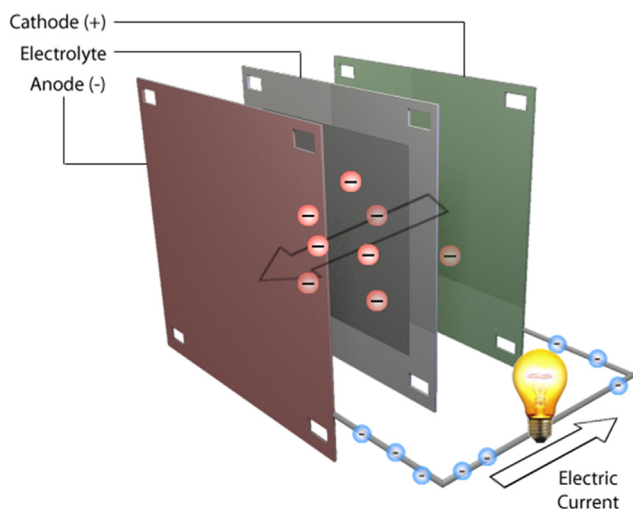
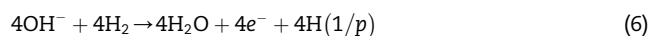


Fig. 1 – CIHT cell schematic.

complete an electrical circuit. In one type of electrolytically regenerative CIHT cell reported previously [2], atomic hydrogen and oxygen are intermittently formed by electrolysis of H₂O in the cell, and the hydrogen catalyst and subsequent hydrinos are formed by a reaction of the reaction mixture during cell discharge with a net gain of electrical output.

Specifically, an exemplary prior tested CIHT cell [2] comprised a nickel mat anode, nickel oxide cathode, and the molten eutectic salt electrolyte LiOH–LiBr. The cell ran off of H₂O supplied as vapor to the cell entrained in an argon flow. The cell was operated under intermittent electrolysis and discharge. Hydrogen and oxygen were generated during the electrolysis phase at the negative and positive electrodes, respectively, and served as the sources of H and nascent H₂O catalyst. The catalyst forming reaction and the counter half-cell reaction that occurred during discharge are given by

Anode:



Cathode:



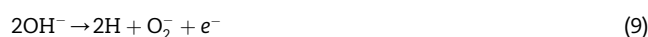
The overall reaction may be



wherein H₂O served as the catalyst. The electrolyte, operating temperature, and H₂O vapor pressure may be controlled such that the standard potential of the electron accepting reaction of Eq. (7) is at essentially 0 V relative to a standard hydrogen electrode to cause a better energy match of the product catalyst with H to facilitate the concerted reaction to hydrino according to Eq. (6).

The power of the hydrino reaction was manifest as an excess current at the operating voltage of the cell set by its conventional chemical composition. The hydrino-reaction-driven excess internal ion current was carried by oxygen containing ions involving oxidation-reduction reactions of the electrolyte and added H₂O that occurred at the electrodes. Based on the Coulomb balance, the internal ion current was significantly manifested and propagated as the spontaneous electrolysis of water. Thus, once initiated, the hydrino reaction may produce electrical power with little to no input electricity as demonstrated experimentally. Exemplary ion-carrying, electrolyte-H₂O reactions that also result in H₂O electrolysis are

Anode:



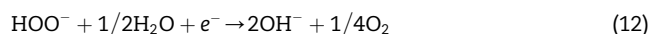
Cathode:



Anode:



Cathode:



Anode:

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