

WEDNESDAY, AUGUST 24, 2005, P.M.

SESSION 43B: INTERNATIONAL SYMPOSIUM ON FUEL CELL AND HYDROGEN TECHNOLOGIES

HYDROGEN PRODUCTION

Sponsor(s): Materials Science and Engineering Section, The Metallurgical Society of CIM

Room: Imperial Ballroom 7

Chairmen: T. K. BOSE, Université du Québec à Trois-Rivières, Canada

PAPER 43B.1 — 16:00

ADVANCES IN HYDROGEN GENERATION THROUGH ALUMINIUM ASSISTED WATER SPLIT REACTION.

E. CZECH and T. TROCZYNSKI, University of British Columbia, Canada

Hydrogen generated through aluminum-assisted water split reaction is a novel, efficient and environmentally friendly method. It has been found previously that the passivation of aluminum can be prevented in neutral (pH=7) or near neutral pH conditions in water by grinding aluminum with a catalyst, such as Al_2O_3 , SiO_2 or SiC . Recently, the best results have been obtained by using water-soluble inorganic salts (WIS), ground with aluminum. The massive, rapid corrosion reaction of the Al-WIS system which takes place in regular tap (or marine, or ground) water can be utilized to produce hydrogen by aluminum-assisted water split reaction, in-situ, on-demand. The reaction offers clean, low-cost, environmentally benign and entirely recyclable technology for on-board on-demand hydrogen generation. Besides pure gaseous hydrogen, only pure solid aluminum hydroxides $AlOOH$ or $Al(OH)_3$ are formed as the reaction products. The hydrogen yield and Al-WIS reaction efficiency are high. From 1 g of mechanically alloyed aluminum powder, up to 1.25 liters of hydrogen were generated, i.e. efficiency up to 92% was achieved. The amount of hydrogen and hydrogen generation rate depend on various reaction parameters. The effect of chemistry and concentration of additives, water temperature, powder particle size and milling conditions on the reaction kinetics will be presented and the possible process mechanism will be discussed.

PAPER 43B.2 — 16:20

ZERO EMISSION GAS POWER - A CONCEPT OF INTEGRATION BETWEEN SOFC AND ABSORPTION ENHANCED GAS REFORMING.

D.O. ERIKSEN, J. MEYER, K. BOK YI, M. CE and A. VIK, Institute for Energy Technology, Norway

ZEG, Zero Emission Gas power is a concept where a SOFC has been integrated with a reactor producing hydrogen from natural gas through absorption enhanced gas reforming. Thus, the process has a very high thermal efficiency and produces electricity and hydrogen from natural gas. In addition, a stream of pure CO_2 is produced and can be deposited or used commercially. A small (1kW_{el}+1kW H₂) demonstration set-up is under construction and results from this and related research will be presented.

PAPER 43B.3 — 16:40

STABILISATION AND REGENERATION OF CeO_2 BASED Pt CATALYST FOR THE WATER GAS SHIFT REACTION.

P.C. HULTEBURG, R.M.S. HAGGBLAD and J. BRANDIN, Catator AB, Sweden

The article deals with stabilisation and regeneration of CeO_2 and CeO_2/ZrO_2 based Pt water gas shift catalysts, subject to high initial deactivation. The reaction gas species effect on the catalyst deactivation was investigated by H₂-TPR. Activity measurements enabled the effect of different promoters, some added to the CeO_2 based catalysts and some to the CeO_2/ZrO_2 based Pt catalysts, to be investigated. The catalysts were also characterised by BET and CO-TPR. Deactivated catalysts activity was restored by using various regeneration methods. Of the two selected carriers the CeO_2/ZrO_2 based Pt catalyst showed the highest resilience to deactivation. For the two different carriers, CeO_2 and CeO_2/ZrO_2 , W and Re were the best promoters when the catalyst was subject to deactivation. Experiments with H₂-TPR indicate a fast initial change in the platinum oxides concentration and composition. The CO-TPR was used to make conclusions about the various regeneration effects of water and oxygen on the catalyst. Finally it is suggested that not one deactivation mechanism is possible and which mechanism that dominates is dependant on the catalyst and the reaction gas composition.