## Study of Catalytic Hydrolysis of Alkaline $NaBH_4$ Solution by Ru/Ni Foam Catalyst


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**Abstract**

A Ni metal form was used to carry the Ru catalyst to induce the hydrogen gas from the $NaBH_4$ solution.

Results show the Ni material was replaced by Ru material. Ru has been coating twice or more to cover all the Ni metal form surface as possible. About 4% of the Ru catalyst plate shows higher hydrogen generation efficiency. Relative to the concentration of $NaBH_4$ solution, the 20 wt.% is consisted with the 4% of Ru catalyst plate. Additional thermal treatment between every coating process, the Ru material can be adhered tightly. Furthermore, adding a layer of plastic film on the Ru catalyst plate can maintain 79% of the generation efficiency after 17 cycles of generation.




## First page example

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# Study of Catalytic Hydrolysis of Alkaline $NaBH_4$ Solution by Ru/Ni Foam Catalyst

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**Keywords :** chemical hydride; sodium borohydride; hydrogen generation; catalyst.

**Abstract.** A Ni metal form was used to carry the Ru catalyst to induce the hydrogen gas from the $NaBH_4$ solution. Results show the Ni material was replaced by Ru material. Ru has been coating twice or more to cover all the Ni metal form surface as possible. About 4% of the Ru catalyst plate shows higher hydrogen generation efficiency. Relative to the concentration of $NaBH_4$ solution, the 20 wt.% is consisted with the 4% of Ru catalyst plate. Additional thermal treatment between every coating process, the Ru material can be adhered tightly. Furthermore, adding a layer of plastic film on the Ru catalyst plate can maintain 79% of the generation efficiency after 17 cycles of generation.

## Introduction

For the purpose of being the fuel energy of fuel cell, condition of hydrogen gas is the essential mechanism in front of the fuel cell inlet. Hydrogen can be stored in compressed tank, liquefied H2, or stored in hydrogen-storing alloys, etc. the activated carbon or nano-fiber materials. However, these mechanisms are not well for portable, besides, due to the low volumetric and gravimetric efficiency of hydrogen storage. Instead of those hydrogen storage methods, liquid methanol fuels, and NaBH4 chemical hydrides can be used as the hydrogen sources for portable purpose. However, the liquid methanol fuels due to its high-temperature reforming processes and slow start condition are not suitable for the requirements of portable PEMFC operation. Alkaline NaBH4 solution (NaBH4), non-flammability and stability in air, has the most extensive attention owing to its combined advantages of high hydrogen capacity (10.8 wt.%), good storability in alkaline solution and reaction controllability, the low reacted temperature and the environmentally benign hydrolysis product (borax, NaBO2). Previous studies on hydrogen production from NaBH4 are summarized in a recent review [1].

Alkaline NaBH4 solution hydrolyzes to hydrogen and sodium metaborate (NaBO2) when being in contact with specific catalysts:

$$NaBH4\ (aq) + 2H2O \rightarrow 4H2 + NaBO2\ (aq) + heat \quad (1)$$

The catalysts based on Ru and Pt have been mostly employed for the hydrolysis of NaBH4 [2-5]. However, non-noble catalysts such as Ni- or Co-based catalysts have also been investigated [6]. According to the results, metallic Ni or Co catalysts exhibited considerably lower activity to the hydrogen generation reaction compared with the noble metal catalysts. However, due to its cost and the less amount quantity force to select the non-noble material for the further mass production.

Based on various experimental observations, a hydrogen generation system using Co–B/Ni foam from NaBH4 solution shown that the optimism flow rate of NaBH4 aqueous solution = 17.5mLmin−1, appropriate concentrations of NaBH4 and NaOH in the feed solution = 20 and 1 wt.%, respectively [7]. The cost of the Co-B catalysts is quite low and the catalysts show high