

## Synthesis and Characterization of $Rh_xS_y/C$ Catalysts for HOR/HER in HBr

Jahangir Masud<sup>a</sup>, Jack Walter<sup>a</sup>, Trung Van Nguyen<sup>a\*</sup>, Guangyu Lin<sup>b</sup>, Nirala Singh<sup>c</sup>, Eric McFarland<sup>c</sup>, Horia Metiu<sup>d</sup>, Myles Ikenberry<sup>c</sup>, Keith Hohn<sup>c</sup>, Chun-Jern Pan<sup>f</sup> and Bing-Joe Hwang<sup>f</sup>

<sup>a</sup> Department of Chemical & Petroleum Engineering  
The University of Kansas  
Lawrence, KS, USA

<sup>b</sup> TVN Systems, Inc.  
Lawrence, KS, USA

<sup>c</sup> Department of Chemical Engineering  
University of California  
Santa Barbara, USA

<sup>d</sup> Department of Chemistry and Biochemistry  
University of California  
Santa Barbara, USA

<sup>e</sup> Department of Chemical Engineering  
Kansas State University  
KS, USA

<sup>f</sup> Department of Chemical Engineering  
National Taiwan University of Science and  
Technology, Taipei, Taiwan

\*Corresponding Author: [cptvn@ku.edu](mailto:cptvn@ku.edu)

### Abstract

There has been growing interest in the hydrogen bromine ( $H_2$ - $Br_2$ ) fuel cell system for electrical energy storage because of its high round-trip conversion efficiency and low costs. The present  $H_2$ - $Br_2$  fuel cells use platinum as a catalyst for the HER/HOR at the hydrogen electrode. While this catalyst is highly active, it is susceptible to poisoning by bromine. Here, we demonstrate a Pt-free  $Rh_xS_y/C$  catalyst which exhibits high activity and stability in  $Br_2/HBr$  solution.

The synthesis procedure for rhodium sulfide on carbon support ( $Rh_xS_y/C$ ) catalyst can be found in the patent by Allen et al. [1]. The carbon supported catalysts ( $Rh:C = 1:4$ ) were prepared

by heating the precursor  $Rh_2S_3$  phase under flowing argon in a quartz furnace tube for 1 hr at several fixed temperatures. These different heat treated catalysts were tested in HBr and  $Br_2$  solutions to determine their HER/HOR activity and stability. The catalyst was also characterized using SEM/EDX, TEM/EDX, XRD and XPS for morphology, elemental chemical compositions, rhodium sulfide phases and particle size. Figure 1 shows a TEM image of one of the samples.

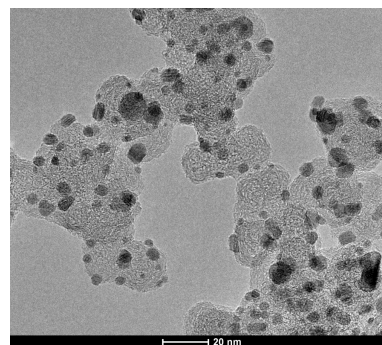


Fig.1: TEM image of a prepared  $Rh_xS_y/C$  catalyst.

### Reference

1. Allen, R.J, Gulla, A.F., "Synthesis of noble metal, sulphide catalysts in a sulfide ion-free aqueous environment", U.S. Patent 6,967,185, 22 Nov, 2005.

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