Pt-Rh coexistence effect on bioethanol steam reforming reaction over Pt-Rh/$LaAlO_3$ catalysts

([1]*Faculty of Science & Engineering., Ishinomaki Senshu Univ.;* [2]*Graduate School of Technology, Industrial and Social Sciences, Tokushima Univ.;* [3]*Sanwa Starch Co., Ltd.*)
○Asahi Sugawara,[1] Kei Sato,[1] Naoko Kikuchi,[1] Tatsuya Yamazaki,[1] Sayaka Kato,[1] Masahiro Katoh,[2] Takushi Yoshikawa,[3] Mamoru Wada,[3]

Keywords: Steam Reforming Reaction of Bioethaol, Pt-Rh Coexisting Effect, Perovskite Support, Hydrogen Yield, Catalyst Deactivation

Problem in steam reforming reaction of bioethanol (BESR) are low activity at low temperature and deactivation due to coking. We found that some Pt-Rh base catalysts were different behavior for BESR from those of mono metal catalysts[1)]. In this study, to investigate coexistence effects of Pt and Rh, several Pt-Rh catalysts supported on $LaAlO_3$ perovskite were prepared, and influences on BESR behavior and on state of noble metals were examined.

$LaAlO_3$ perovskite support was prepared by the citrate method.[2)] Pt(n)-Rh(m) catalysts were obtained by impregnation of H_2PtCl_6 and $RhCl_3$ aqua solutions onto $LaAlO_3$ support and calcination at 1073K in air, where n and m are Pt and Rh supporting amount(wt%), respectively. EtOH and BioET (ethanol/H_2O mol ratio = 1/9) used as reactant solutions were prepared by dilution of reagent ethanol and real bioethanol (Sanwa Starch, ethanol 74wt%) with distilled water. Reaction tests were carried out at 673-973K at 0.20 mL/min of the reactant solution and 50 mL/min of N_2 carrier with 0.1 g of catalyst.

H_2 yields of Pt(2) and Pt(1)-Rh(0.5) catalysts for EtOH were shown in Fig.1. The yields were higher at higher reaction temperature, but decreased with time on stream at all temperature. The activities of Pt(2) were low, but the activities were significantly improved with addition of Rh. Considering other reaction products (CO_2, CH_4, and acetaldehyde), H_2 on Pt(2) catalyst was mainly produced with acetaldehyde by dehydrogenation reaction of ethanol, whereas on Pt(1)-Rh(0.5) catalyst, steam reforming reaction of ethanol proceeded. Since the Pt particle sizes on Pt(2) and Pt(1)-Rh(0.5) were nearly equal (30~40nm), and the surface area of Pt(1)-Rh(0.5) was smaller than that of Pt(2), the enhancement of H_2 formation activity may be due to coexistence effect of Pt and Rh.

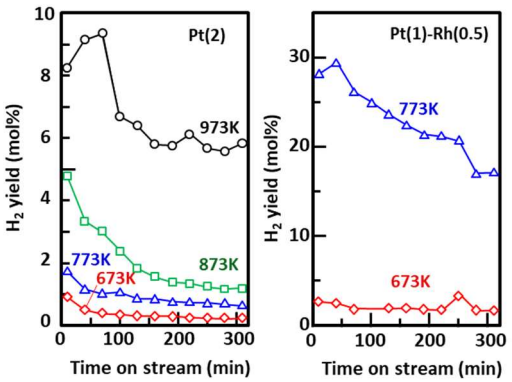

Fig.1 H_2 yields on Pt(2)/$LaAlO_3$ and Pt(1)-Rh(0.5)/$LaAlO_3$ catalysts for EtOH

1) H. Abe, *et.al.,* 124th CATSJ Meetings (2019) **P097**
2) Asiel Hernández Martínez, *et. al., Catalysis Today,* **372**, 59-69 (2021)