

Catalytic Hydrogenation of a novel Liquid Organic Hydrogen Carrier: Eutectic Mixture of Biphenyl and Diphenylmethane

조영석, 한다정, 신병수, 장문정, 강정원, 한종희,
남석우, 윤창원[†]
한국과학기술연구원
(cwyoon@kist.re.kr[†])

After screening potential candidates for liquid organic hydrogen carrier, or LOHC, a novel mixture is suggested: a mixture of biphenyl ($C_{12}H_{10}$, solid) and diphenylmethane ($C_{13}H_{12}$, liquid) with a mass ratio (wt%) of 35:65. The suggested material is liquid at ambient temperature with a viscosity of 3.0 cP at 25 °C and a vapor pressure of 1.4 Pa at 25 °C, meeting the requirements for an efficient hydrogen storage material. By testing with various catalyst materials and at operating conditions, the eutectic mixture exhibited a superior activity for hydrogenation reactions conducted at 120 °C under 50 bar of H₂ pressure in the presence of a Ru (5 wt%)/Al₂O₃ catalyst. Hydrogen uptake of the mixture was close to full conversion, which corresponds to 6.9 wt% and 60.1 g/L of gravimetric and volumetric hydrogen storage capacities, respectively.