Hydrogen Spillover: Effects of Lewis Acidity in Physical Diluents

이송현, 최민기†
KAIST
(mkchoi@kaist.ac.kr†)

Hydrogen spillover is surface migration of activated hydrogen atoms (H) from a metal to a support where H_2 dissociation is improbable. Earlier works reported that Pt/LTA alone did not show appreciable catalytic activities, whereas catalyst diluted with acidic oxides showed markedly enhanced activities. However, it was often speculated without experimental evidence that activated hydrogen generated from Pt/LTA can migrate to the diluents surface where organic reactants can react with spilt-over hydrogen. In this work, we carefully studied benzene hydrogenation activities of Pt/NaA and its decationized form Pt/HA, before and after the physical dilution with various metal oxides possessing different Lewis and Brønsted acidity. The negligible activity of Pt/NaA increased significantly after mixing with various acidic oxides. The dilutions, however, resulted in a significant alteration of the structure of Pt/NaA due to solid-state H^+-exchange, which made the catalytic interpretation vague. In contrast, Pt/HA structure did not show any appreciable change after the dilution, and thus could be used as an ideal catalytic model system for studying inter-particular H spillover. The catalytic results showed that Al-rich metal oxides with abundant Lewis acid sites are effective for enhancing the catalytic activity.