Effects of Surface Characteristics on the Catalytic Performances for Dehydrogenation of 2-[(n-methylcyclohexyl)methyl]piperidine (H_{12}-MBP) as the Liquid Organic Hydrogen Carrier (LOHC)

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Hydrogen is considered as a promising renewable energy source. To make the hydrogen society feasible, technologies for safe storage and transportation of hydrogen must be developed. Liquid organic hydrogen carrier (LOHC) technology is considered as one of the promising means. In this study, we used nanoporous Al_2O_3, CeO_2, TiO_2, ZrO_2, and SnO_2 as the supports for Pd metal nanoparticles, and investigated their effects of surface characteristics on their catalytic performances for dehydrogenation of 2-[(n-methylcyclohexyl)methyl]piperidine (H_{12}-MBP) as the H_2-rich LOHC storing dischargeable 6.15 wt% of H_2. According to the kind of metal oxide supports and loadings of Pd, the supported Pd metal nanoparticle catalysts exhibited very different catalytic activity (H_2 yield), reaction kinetics (dehydrogenation rate), and recyclability. The present work demonstrates how the surface of metal oxides controls the Pd-catalyzed dehydrogenation and thereby provides insight for the design and innovation of new heterogeneous catalysts with good catalytic activity and recyclability.