PdCu supported on dendritic mesoporous CexZr1-xO2 as superior catalysts to boost CO2 hydrogenation to methanol

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Abstract

A dendritic PdCu/Ce0.3Zr0.7O2 (PdCu/CZ-3) catalyst was prepared for boosting the catalytic performance of CO2 hydrogenation to methanol (MeOH). The open dendritic pore channels and small particle sizes increase the accessibility between the active sites (PdCu alloy and oxygen vacancy) and the reactants (H2 and CO2). More spillover hydrogen could be generated due to the highly dispersed PdCu active metals over the PdCu/CZ-3 catalyst. PdCu/CZ-3 can stimulate the generation of more Ce3+ cations, which is beneficial to produce more oxygen vacancies on the surface of the CZ-3 composite. Spillover hydrogen and oxygen vacancy could promote the formate and methoxy routes over PdCu/CZ-3, which were the primary intermediates to produce MeOH. PdCu/CZ-3 displayed the highest CO2 conversions (25.5 %), highest MeOH yield (6.4 %), highest PdCu-TOFMeOH (7.7 h-1) and superior 100 h long-term stability than those of other PdCu/CexZr1-xO2 analogs and the reference PdCu/CeO2 and PdCu/ZrO2 catalysts.

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