

Catalytic transfer hydrogenation of 5-hydroxymethylfurfural to 2,5-dimethylfuran over supported ruthenium catalysts

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The hydrogenation of biomass-derived (HMF) to 2,5-dimethylfuran(DMF) is a key reaction in upgrading furanic compounds into platform molecules toward the production of transportation fuels and chemicals. While the hydrogenation of HMF using molecular hydrogen and copper based catalysts demonstrates an excellent yield and selectivity for DMF, it requires high-pressure H₂ increasing process costs. In this study we introduce an alternative route for the conversion of HMF to DMF through catalytic transfer hydrogenation (CTH) where a hydrogen donor is used as a hydrogen source, instead of molecular H₂. This approach selectively produced DMF from HMF using 2-propanol as a hydrogen donor and Ru/C as a catalyst. A combination of kinetic experiments and catalyst characterizations revealed that an active Ru/C catalyst exhibited bi-functional behavior, in which Ru catalyzes the dehydrogenation of 2-propanol and the hydrogenation-hydrogenolysis of 5-hydroxymethylfurfural and RuO₂ promotes dimethylfuran production via hydrogenolysis.