Direct conversion of CO_2 to liquid fuels over $ZnZrO_x$ with Mo, Ga and Zn modified HZSM-5 composite catalysts

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Catalytic hydrogenation of the greenhouse gas CO_2 is one of the promising approaches, since it offers a sustainable route to produce fuels and chemicals, and it can also help to reduce the dependence on non-renewable energy resources. Wherein, the synthesis of hydrocarbons especially C_5-C_{11} including aromatics is remarkably significant as they are important gasoline range fuels. Bifunctional catalysis combining metal oxides and zeolites is a promising strategy for the direct hydrogenation of CO_2 into aromatics. Thereby, zeolite is an essential component of tandem catalysis due to its unique shape selectivity and acidity. Thus modification of zeolite has attracted much attention in order to manipulate the product selectivity by controlling strength of acid sites. Herein, we report the CO_2 hydrogenation over composite catalyst with parent and metal (i.e. Mo, Ga and Zn) modified HZSM-5, where metals were incorporated in framework of ZSM-5.