Mesoporous bimetallic spinel oxides having basicity for CO_2 hydrogenation

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ReducingThe reduction of atmospheric CO_2 concentrations is an environmentally and technically significant matterissue in the current century. CO_2 hydrogenation to other chemicals (e.g., CO, CH_4, methanol) will be one of the solutions for CO_2 mitigation process. For CO_2 hydrogenation, mesoporous spinel oxides ($ZnAl_2O_4$, $CuAl_2O_4$, $CoAl_2O_4$ and, $MgAl_2O_4$) haveare been made synthesized and characterized by various tools. One remarkable feature of these spinel oxides is that they have different basic properties (quantity and strength) as characterized by temperature-programmed desorption of CO_2. Accordingly, the affinity of catalytic surfaces to Lewis acidic CO_2 is different and hence they show the different activity. Most catalysts except $CoAl_2O_4$ showed high CO selectivity and those catalytic activities exhibited substantial stability. Among them, $CuAl_2O_4$ having the largest amount of strong basic sites showeds the highest activity and CO selectivity, which results from the high affinity with Lewis acidic CO_2. The reactivity of each catalyst figured out to be linearly proportional to the amount of strong basic sites, not the total amount of basic sites.