Pd promotional effect on highly stable and selective Cu-CeO_2 solid solution catalyst for efficient CO_2 hydrogenation to methanol

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The CO_2 hydrogenation to methanol route still suffers from the poor methanol selectivity and stability of the catalyst, particularly the supported catalysts. Herein, we have synthesized Cu-CeO_2 and Pd promoted Pd-Cu-CeO_2 solid solution catalyst by co-precipitation method and evaluated their activity for methanol synthesis. The activity tests for the catalysts were conducted in a high pressure packed bed reactor in the temperature range of 230-290 °C at 50 bar pressure. The in-depth characterization of the catalyst suggested that the combination of metal and oxide sites on Cu-Ce interface with the generation of surface oxygen vacancies were co-related for the high selectivity and productivity of methanol. These important findings unravel the roles of different active sites for CO_2 and H_2 activation which can lead to a practical way to design a highly efficient catalyst for methanol synthesis.