

**CO<sub>2</sub> methanation property over Pd-MgO-SiO<sub>2</sub> nano catalyst**

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The potential utilization of CO<sub>2</sub> as an abundant and inexpensive chemical feedstock is of widespread interest. The methanation of CO<sub>2</sub> has a range of applications including the production of synthetic natural gas and the removal of trace amounts of CO<sub>2</sub> in hydrogen feeds for ammonia synthesis. The methanation of CO<sub>2</sub> was carried out using Pd and Ni based nano catalysts at temperatures ranging from room temperature to 450°C in the fixed bed reactor. At 450°C the Pd-Mg/SiO<sub>2</sub> nano catalyst had greater than 95% selectivity to CH<sub>4</sub> at a CO<sub>2</sub> conversion of 59% while Pd/SiO<sub>2</sub> has activity only for CO<sub>2</sub> reduction to CO and MgO/SiO<sub>2</sub> alone is relatively inactive. Pd-MgO-SiO<sub>2</sub> nano catalyst shows higher activity and selectivity to CH<sub>4</sub> compared to Ni and the other catalysts. A bifunctional mechanism over Pd-MgO-SiO<sub>2</sub> nano catalyst is proposed whereby CO<sub>2</sub> is stabilized by the MgO-SiO<sub>2</sub> as a surface carbonate and sequentially hydrogenated to form methane.