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## Reverse microemulsion-synthesized copper-doped cerium oxide catalyst for reverse water gas shift reaction

Reverse water gas shift (RWGS) reaction catalytically converts $CO_2$ to CO producing syngas (a mixture of CO and $H_2$) which can be used to produce a variety of fuels and chemicals. It is an emerging technology that has a great potential for Ci $O_2$ utilization. In this research, copper-doped ceria (x-CuO/$CeO_2$, where x denotes weight percentage (wt%) of CuO) was synthesized via the reverse microemulsion (RME) method. X-Ray diffraction (XRD) analysis showed no separate phase of copper (Cu) or copper oxides (CuO or $Cu_2O$) indicating that Cu was incorporated into the $CeO_2$ lattice, replacing Ce. $CO_2$ TPD (temperature programmed desorption) was conducted to estimate the activation energy of desorption ($E_{a,des}$). The $E_{a,des}$ magnitude increased as Cu concentration increased, which can be attributed to the oxygen vacancies that formed due to Cu doping. Catalytic performance was evaluated in a range of temperatures and space velocities (300-600 °C and 20,000 – 120,000ml/(g h)). All samples (0.3-17 wt%-CuO/$CeO_2$) were 100% selective to CO generation and the higher doping concentrations (6-17 wt%) showed conversion values close to equilibrium in the temperature range of 500-600°C. The 0.38 wt% catalyst demonstrated a relatively stable performance for 100 h on stream, with only minor conversion decline (from 52% to 48%).