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Highly Selective Conversion of CO2 to CO on Cu Nanoparticles

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Abstract : Carbon dioxide (CO2), a key greenhouse gas produced from both anthropogenic and natural sources, has been recently considered to be an important C1 building-block for the synthesis of many industrial fuels and chemicals. Catalytic hydrogenation of CO2 using a heterogeneous system is regarded as an efficient process for CO2 valorization. In this regard CO2 reduction to CO via the reverse water gas shift reaction (RWGSR) has attracted much attention as a viable process for large scale commercial CO2 utilization. This process can generate syn-gas (CO+H2) which can provide an alternative route to direct CO2 conversion to methanol and/or liquid HCs from FT reaction. Herein, we report a highly active and selective silica supported copper catalyst with efficient CO2 reduction to CO in a slurry-bed batch autoclave reactor. The reactions were carried out at 200°C and 60 bar initial pressure with CO2/H2 ratio of 1:3 with varying temperature, pressure and fed-gas ratio. The gaseous phase products were analyzed using FID while the liquid products were analyzed by using FID detectors. It was found that Cu/SiO2 catalyst prepared using novel ammonia precipitation-urea gelation method achieved 26% CO2 conversion with a CO and methanol selectivity of 98 and 2% respectively. The high catalytic activity could be attributed to its strong metal-support interaction with highly dispersed and stabilized Cu+ species active for RWGSR. So, it can be concluded that reduction of CO2 to CO via RWGSR could address the problem of using CO2 gas in C1 chemistry.

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