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# In situ loading of highly-dispersed CuO nanoparticles on hydroxyl-group-rich $SiO_2$-AlOOH composite nanosheets for CO catalytic oxidation

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**Abstract:** Emerging hierarchical porous $SiO_2$-AlOOH (SA) composite nanosheets were synthesized via structural reorganization of natural layer kaolin clay (KC). CuO nanoparticles were further attached on SA by in-situ chemical precipitation method for CO catalytic oxidation. The results demonstrated the relationship between synthesis, structure and performance of the catalytic system. Hydroxyl-group-rich SA composite nanosheets with high specific surface area could ensure the well dispersion of CuO nanoparticles through in-situ loading method without high-temperature calcination, further increasing the Cu active sites and retaining adequate hydroxyl groups. Hierarchical porous structure resulting from self-assembly of nanostructures (varisized sheets and particles) showed excellent physical adsorption performance for reactant gases. DRIFTS and XPS results revealed the possible role of three main surface reactive sites in this CuO/SA catalytic system: the coordinatively unsaturated $Cu^{2+}$ of Si(Al)-O-Cu bonds adsorbed gaseous CO, the $Cu^{2+}$ with anionic vacancies on highly-dispersed CuO nanoparticles adsorbed gaseous $O_2$, and the surface hydroxyls could promote CO oxidation by the chemisorption of gaseous CO as a formation of formate species to increase the CO