ABSTRACT

This work focuses on the removal of nitrogen oxides (NOx) from industrial flue gas as a part of CO_2 purification step prior to the carbon capture, storage and utilization unit. The study proposes the use of catalytic reduction of NO to non-toxic nitrogen (N_2) using CO, a component in the industrial flue gas, as a reductant. The study outlines the development of catalytic materials by investigating the influence of type of treatment gas to derive mixed oxides, molar ratio of active metals (here, Cu and Co) in the material and treatment temperature on the catalytic performance. It was concluded that the mixed oxide material with molar Co/Cu = 2 and treated under the flow of CO_2 at 400°C not only showed the optimal catalytic performance but also was found to be stable under the reaction condition and superior to the commercial Pt-containing catalytic materials in NO reduction activity. Moreover, a kinetic model was developed for the reaction system using Langmuir Hinshelwood Hougen Watson kinetics and parameter regression was performed. Finally, $La_yCo_{1-x}Cu_xO_3$ perovskite materials were introduced as potential materials for NO reduction reaction and upon investigating their catalytic activities, it was concluded that they are active for NO reduction but further studies into optimisation of material composition is required to achieve optimal catalytic performance.