The yields of NO from combustion of bituminous coal, lignite, and biomass chars were investigated in O2/N2 and O2/CO2 atmospheres. The experiments were performed in a laboratory-scale fixed-bed reactor in the temperature range of 850-1150 °C. To minimize thermal deactivation during char preparation, the chars were generated by in situ pyrolysis at the reaction temperature. The NO yield clearly decreased and the CO yield increased when the atmosphere was altered from O2/N2 to O2/CO2 at 850 °C; but only small differences in NO and CO yields were observed between the two atmospheres at 1050-1150 °C. To examine how CO influences the NO yield, the effect of CO on NO reduction over char as well as NO reduction by CO over ash was investigated in the fixed-bed reactor. Furthermore, the influence of CO on the homogeneous oxidation of HCN, possibly a product of the char-N oxidation, was evaluated using a detailed chemical kinetic model. The results indicate that CO influences the NO yield from char combustion through two paths at 850 °C: (1) CO accelerates NO reduction over char and (2) CO accelerates HCN oxidation, increasing the possibility of NO reduction over char. Both effects were more pronounced at 850 °C than at 1050-1150 °C. The present work indicates that the effect of CO2 on NO formation in oxy-fuel combustion in fluidized beds can partly be attributed to heterogeneous reactions, whereas for high-temperature pulverized fuel combustion, CO2 mainly affects the volatile chemistry. © 2014 American Chemical Society.
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