The realization of low emissions of briquette combustion in a coal-fired stove by decoupling combustion technology

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Although many measures have been taken to diversity the structure of China's energy consumption, the dominant position of coal as primary energy source still cannot be changed in the coming future. Consequently, there is an urgent need for the clean and high-efficiency utilization of coal. Domestic coal-fired stoves are thought to be one of the important causes of severe dust-haze weather in north China, but we can do less with domestic coal-fired stoves than with industrial stoves due to the economic and technological constraints. The decoupling combustion (DC) technology, invented by Institute of Process Engineering (IPE), Chinese Academy of Sciences (CAS), can facilitate the simultaneous suppression of nitrogen oxides and carbon by utilizing low NOx combustion under low temperature and reduction atmosphere in the pyrolysis chamber as well as after-combustion of char and pyrolysis gas under high temperature and oxidation atmosphere in the combustion chamber. While using the bituminous briquette as fuel, the emissions of particulate matter and sulfur dioxide can be suppressed, thus realizing the low emissions of coal combustion in a coal-fired stove by making the matching of fuel-stove.

In this study, the combustion of briquette from bituminous coal in different operation modes in a typical decoupling stove is tested and simulated. The effects of the main reducing components in pyrolysis gas as well as char on NOx reduction were numerically investigated, and the optimization of the decoupling coal-fired stove is thus further conducted, in which NO and CO emissions can be expected to be less than 100 mg/m3 (9% Vol. O2) and 300 mg/m3 (9% Vol. O2).