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COMBUSTION CHARACTERISTICS OF A TWIN FUEL CERAMIC BURNER USING RECYCLED PET-RESIN POWDER AS AN AUXILIARY FUEL

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ABSTRACT

Energy recycling of waste PET bottles is attempted in this investigation to utilize as an alternative fuel. In the ceramic kiln furnace commercial grade LPG is generally employed as a gaseous fuel and used simply as a heat source. LPG is one of the virgin chemical products and is always exposed to unstable price fluctuation on one hand. PET-resin is, on the other, one of the hydrocarbon fuels having purity of 99.9 %. From the view point of energy saving and low environmental impact, therefore, it is considered to be very useful and important to replace a part of LPG with an alternative fuel such as PET-resin, after being broken into fine powder having a mean diameter ranging from 100 ~ 150 μm. PET-resin has a relatively low heating value of 21.8 MJ/kg, about half of that of LPG, and burns as yellow flame, but not as blue flame as gaseous propane burns. The feature may ensure spatially uniform heating by radiation heat transfer, constituting an extremely valuable advantage to ceramic kiln furnaces.

In this paper, in order to make possible constant and continuous fuel supply without any deposit on the supply line, a PET-powder feeder is first devised and constructed by employing the secondary air as a carrier fluid. According to out-of-furnace combustion characteristics, a ceramic burner suitable for twin-fueled combustion is then reconstructed to burn PET-powder as an auxiliary fuel along with LPG as a main fuel, by improving an original commercial ceramic burner (Figs. A-1 and A-2). Under the conditions of a constant heat input of 11.6 kW and a constant replacement rate of PET-powder of 18.6 %, flame appearances are first observed, measurements of temperature and exhaust gas composition are then made by varying the overall equivalence ratio within a range of 0.63 ~ 1.2, and finally in-furnace combustion characteristics of the proposed twin-fueled ceramic burner are examined. It is found that the proposed burner realizes a spatially uniform temperature distribution and clean exhaust gas emission, and that it has sufficient potential to apply and to retro-fit to the established ceramic burners.

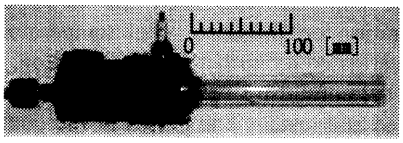

Figure A-1 Appearance of the improved ceramic burner

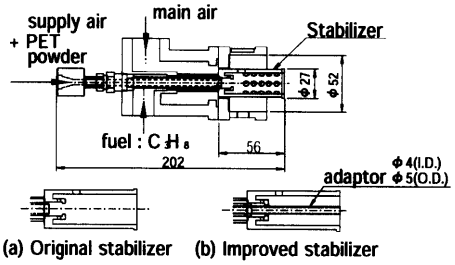

Figure A-2 Detailed construction and dimensions of the burner