Development of a swirling fuel nozzle for firing a mixed gas with wide composition variations

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This study has been carried out to develop a fuel nozzle for firing a composition-varying mixed gas (MXG) consisting of steel plant's off-gases, coke oven gas (COG) and blast furnace gas (BFG), and LNG. The major objective of this study is to maintain the combustion performance of a burner in case of mixing LNG up to 20 vol.% which causes a decrease in flame speed factor of the mixed gas about 70%. Combustion tests for various reheating furnace burners used at rolling mills have been performed using appropriate experimental apparatus. To enhance the air-fuel mixing for compensating the relatively lower combustibility of LNG compared with COG, various types of fuel nozzles have been made and tested. It was shown that a swirling fuel nozzle is promising for enhancing flame stability with LNG addition. Optimization tests of swirling fuel nozzles for field burners have been performed to confirm the combustion performance and to derive design guidelines. An angle of 15° with burner axis for each injection hole was selected as an optimum for multi-hole nozzle burners. A swirler having 30° vanes inside the fuel pipe was selected for burners adopting round pipe and annulus-type fuel nozzles.