EXPERIMENT ON CYLINDRICAL NI-AL RADIANT BURNER WITH HEAT RECUPERATION[1]

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For generating infrared fluxes gas-fired radiant burners are widely used. Currently, radiant burners are successfully used for heating industrial zones, as well as for drying and thermal processing of materials. This study has been motivated by the experimental findings on temperature and radiative characteristics of cylindrical burners from Ni-Al alloy [1] that reveal a significant improvement in the radiation efficiency of burners operated in the internal combustion mode. Here, the flame stabilizes in the internal cavity of the cylindrical burner that allows achieving a radiation efficiency of about 60%. A further increase in radiation efficiency is possible owing to preheating of the fuel-air mixture. Therefore, the objective of this study is to investigate the effects of heat recuperation on radiation characteristics of cylindrical burners.

To create cylindrical burner, an intermetallic Ni-Al alloy is used, which is characterized by high oxidation resistance and high-temperature strength. The burner are made by the combustion synthesis in the form of hollow cylinders with a hemispherical head, the diameter of 48 mm, total length of 77 mm, and the wall thickness of 8.5 mm. Porosity is 55%, the average size of the frame elements is 1000 μm. The burner was installed inside a conical hollow-type recuperator made from an aluminum alloy (fig. 1). The natural gas with the H_i = 35,62 kJ/nl has been used as a fuel. The composition of the fuel-air mixture was controlled by precision flow controllers (Eltochpribor, Russia). The radiation efficiency was measured with using a 12A P/N 7Z02638 sensor (Ophir, Israel) in accordance with the procedure described in [1]. Following modes of operation have been applied: air-fuel ratio in the range of 1.1 - 1.46, firing rate 100 - 320 kW/m^2. For each experimental point, the measurements were repeated three times and the resulting data were calculated for confidence level 95%. The findings have suggested that heat recuperation is an effective method of enhancement of the radiation efficiency (see the table).

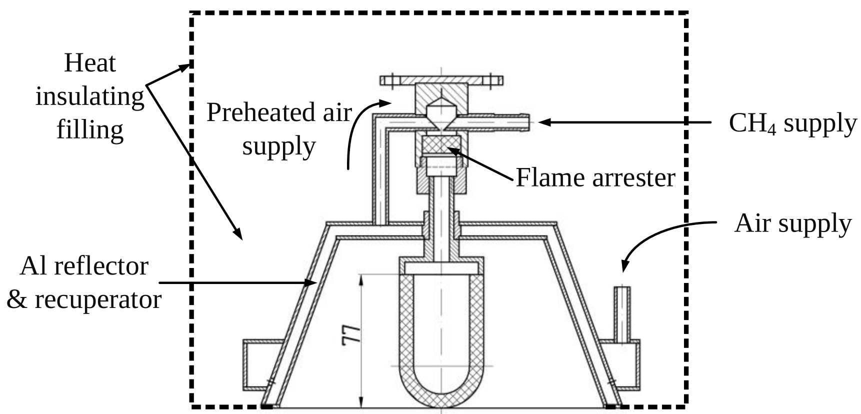

Fig. 1. Scheme of the experimental burner with heat recuperation

Firing rate [kW/m^2] Fixed air-fuel ratio α = 1.10	**Rad. Eff. [%]**	**Air-fuel ratio** Fixed firing rate 100 kW/m^2	**Rad. Eff. [%]**
100	65.9 ± 1.0	1.10	65.9 ± 1.0
160	67.3 ± 1.6	1.28	63.9 ± 1.0
220	63.5 ± 2.3	1.46	61.9 ± 0.9
280	61.5 ± 0.7		
340	58.8 ± 4.1		

REFERENCES

[1] *Fursenko R, Maznoy A, Odintsov E, Kirdyashkin A, Minaev S, Sudarshan K. // International Journal of Heat and Mass Transfer. – 2016. – 98. – 277-284.*

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