Industrial burners on hydrogen: experimental investigation

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Interest is awakening for firing hydrogen as renewable alternative to natural gas. Several customers of Honeywell Thermal Solutions (HTS) are considering swapping (partially) to hydrogen as combustion fuel for their thermal processes.

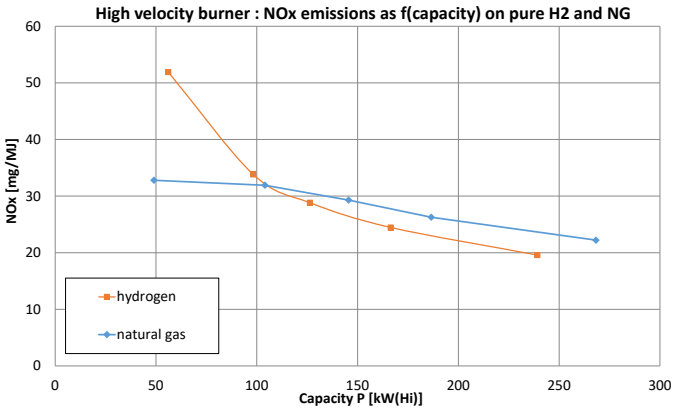
Several test campaigns were conducted in the HTS labs to determine which products its portfolio can handle hydrogen or a blend of natural gas/hydrogen. Experimental testing was also conducted at customer labs as well as with the DNV and GWI labs.

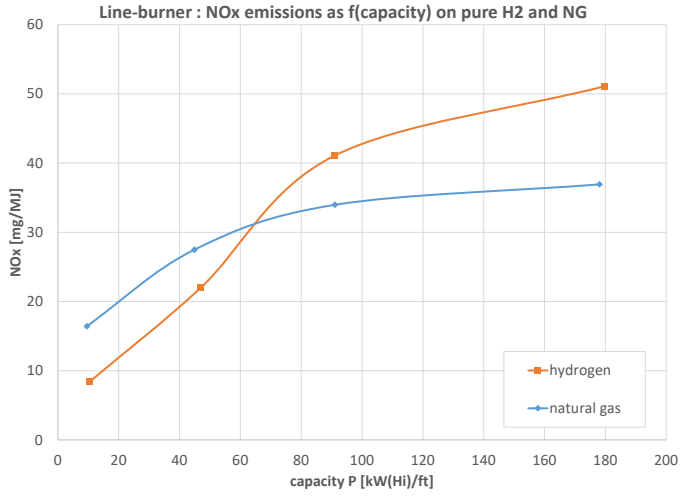
Recently, a number of orders for complete burner systems able to fire on hydrogen have been passed.

In this presentation is reported some of the testing done on 2 industrial burners on hydrogen and blends of hydrogen/natural gas. The first is a high temperature, high velocity burner typically used for incineration applications. The second burner is a modular line-burner used for process air heating. Both burners can fire pure hydrogen.

The influence of the fuel swap on temperature of critical burner components, emissions of NOx, flame dimensions and flame supervision signal is presented.

On the first high-temperature application burner, temperatures of metallic components in contact with the flame remain low and acceptable. At burner's nominal capacity the NOx emissions remain on the same level as on natural gas, while increasing with reducing capacity. Flame sensing with UV remained unaffected by the swap. Visible flame length is slightly shorter, diameter unaffected. Hence burner can fire hydrogen without any material modification.





On the second low-temperature application burner, temperatures of mix plates increased markedly, and the flame intensity shifted towards to burner body. Higher NOx emissions were recorded on H2 compared to natural gas, and this difference in emissions increases with increasing capacity. Minimum firing capacity of the burner is limited on H2 due to flame sensing issues close to minimum capacity. Visible flame length is shorter on

H2. Upgrading the burner with higher grade mix plates is the only modification required to fire the burner on hydrogen.

Several other burners in the HTS portfolio were tested too, and demonstrated their inability to fire on 100% hydrogen, due to flashback, thermo-acoustic resonance and/or burner component's overheating. The acceptable amount of hydrogen in a blend of natural gas/hydrogen for these burners is in the process of being determined.