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Radiant Tube Burner preliminary tests

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Biomass Gasification in a novel 50kW$_{th}$ Indirectly Heated Bubbling Fluidized Bed Steam Reformer: Radiant Tube Burner preliminary tests

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In the global chase towards sustainability and cleaner ways of generating power, the utilization of biomass as a feedstock for clean energy conversion processes has become increasingly interesting, since biomass is potentially a CO_2-neutral energy source. Gasification is an attractive and versatile option for the conversion of a wide variety of biomass feedstocks into a product gas mainly composed by CO, H_2, CO_2, H_2O and CH_4, that can be used for (combined) heat and power (CHP) production, transportation fuels and chemicals.
In indirectly heated gasification, also known as second generation or allothermal gasification, the heat needed for the desired reactions is provided by ex-situ oxidation reactions and this leads to a higher quality product.

This project is carried out in cooperation with the Dutch company Petrogas Gas-Systems. In particular, Petrogas Gas-Systems and the TU Delft Process & Energy/Large Scale Energy Storage section are designing, engineering, and commissioning a small 50 kW$_{th}$ Indirectly Heated Bubbling Fluidized Bed Steam Reformer (IHBFBSR) heated by two radiant tube burners placed vertically inside the reactor, one at the top and one at the bottom.

An experimental campaign has been performed in order to test the bottom radiant tube burner before installing it in the gasifier. The radiant tube was fired in under different conditions; firstly in an empty tube and afterwards in the presence of different bed materials (vermiculite and corundum with two different particular sizes). The aim of the study was to determine whether the heat was released symmetrically, the repeatability of the tests, the most convenient thermocouple configuration for the actual gasification tests and also to study the effect of the different bed materials on the exhaust gas emissions (CO,CO_2 and NO_X).
Besides the observed repeatability, the tests showed that the heat was released symmetrically, and that only NO_x emissions were slightly influenced by the bed material used mainly due to differences in the temperature of the exhausted gas.

Further tests will be performed in order to study also the behaviour of the top radiant tube burner. Subsequently, both of them will be installed in the gasifier and biomass gasification experimental campaigns will be carried out.

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