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Entrained-flow gasification of pyrolysis oil – Influence of flame structure on fuel conversion

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High pressure entrained flow gasification is a key technology for closing the carbon cycle in a future circular economy. Basic process technology is investigated at KIT at the 5 MW high pressure entrained flow gasifier as part of the CarbonCycleLab, which covers the whole process chain for conversion of waste based carbon into high quality products. For liquid and sus pension fuels, fuel conversion and the for mation of intermediates mainly depend on the processes in the flame zone, influenced by droplet size, fuel distribution, and flow field generated by the burner nozzle.

The influence of the gas exit area of the burner nozzle on flame structure and fuel conversion was examined by gasifying beech wood pyrolysis oil at an atmospher ic pressure entrained flow gasifier. OH LIF and LII delivered data on the oxidation zone and soot formation, re spectively. Using the measured gas phase composition at the reactor outlet and elemental balancing, characteristic parameters like carbon conversion and cold gas efficiency were derived. The results show a clear influence of the burner configuration on the flame structure and fuel conversion. A smaller gas exit area results in a significant decrease of the flame length, lower methane concentration in the syngas, and lower soot forma tion. This demonstrates the impor tance of burner design on syngas quality and yield.

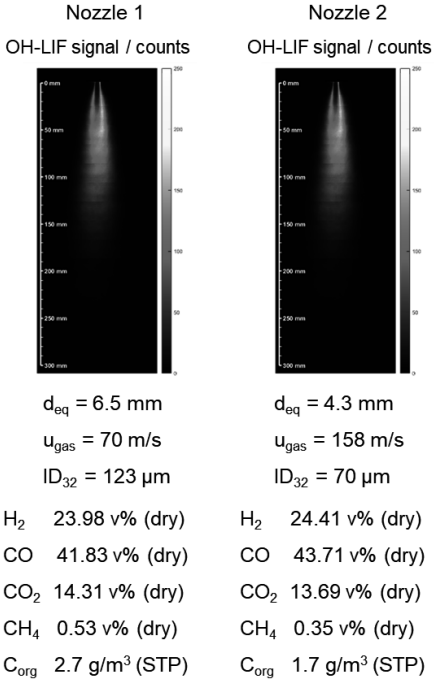

Figure. OH LIF signals and syngas composition for two nozzles with different gas exit area.

[1] S. Fleck et al., *Fuel* **2018**, *217*, 306 319. DOI: 10.1016/ j.fuel.2017.12.077
[2] C. Hotz et al., *Fuel* **2021**, *304*, 121392. DOI: 10.1016/ j.fuel.2021.121392