PLASMA-ASSISTED BIOMASS GASIFICATION IN AN ATMOSPHERIC DROP TUBE REACTOR

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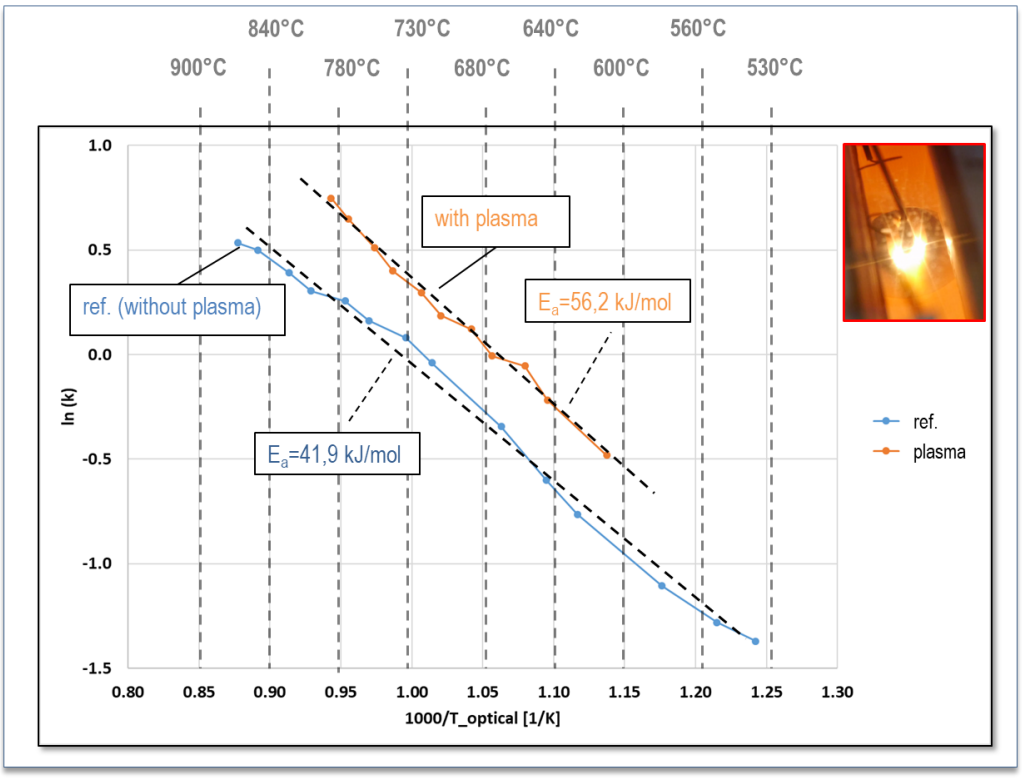
Abstract

At the Chair of Energy Process Engineering, an atmospheric drop tube reactor has been built for Investigation of biomass gasification with non-thermal plasma. Compared to conventional thermal gasification, the plasma-assisted process has the benefit of better reaction kinetics due to produced free radicals and particles with high temperature [1].

The reactor consists of preheating zone, window zone, reaction zone and quench zone. At the top of the reactor, fuel particles and the conditioned main water steam are injected. The allotherm water steam gasification starts in the window zone, in which the fuel particles get in contact with plasma filaments. In the reaction zone, a movable sampling probe is inserted from the bottom, which allows a sampling along the whole reaction zone. The gas sample gets immediately cooled down and sent for gas analysis.



In the suggested presentation, the experimental methods and the total test rig will be introduced first. The carbon conversion of the injected fuel particles, calculated from the measured gas concentrations, is compared to the reference case. The reaction kinetics of plasma gasification is presented in the Arrhenius diagrams for discussion (Fig. 1).

Figure 1: comparison of reaction kinetics between plasma gasification and reference case

References

[1] Sun, W., et al. (2012). "Kinetic effects of non-equilibrium plasma-assisted methane oxidation on diffusion flame extinction limits." Combustion and Flame 159(1): 221-229.