

Thermal Partial Oxidation and Soot Formation in Porous Inert Media

To the Faculty of Mechanical, Process and Energy Engineering
of the Technische Universität Bergakademie Freiberg

approved

THESIS

to attain the academic degree of

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Dr.-Ing.

submitted

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*To my family
and friends*

Berichte aus der Energietechnik

Alexandra Loukou

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in Porous Inert Media**

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Freiberg, February 2014

SHORT SUMMARY

This work examines the process of non-catalytic syngas generation from rich methane / air mixtures. The process is carried out using a porous media based reactor. The employed porous media are inert ceramic materials, which promote internal heat recirculation within the reaction zone. In this way, the temperature of the gas flow can be locally higher than the adiabatic flame temperature. This effect is known as excess enthalpy combustion and can promote reaction stability and reforming efficiency. Tests under experimental conditions, which are pertinent to the practical application of the reactor within fuel cell based systems, demonstrate its applicability and the benefits of reaching superadiabatic temperatures. Characteristics of soot particles in the syngas are mapped for ranges of sets of operating conditions. The results show that in regimes of efficient reactor operation, soot formation cannot be prohibited. Nevertheless, the obtained data are useful in order to control size and particle concentrations and to elaborate on techniques for particle retention.

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